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Automobile Cylinders in the Machine Shop

How They are Handled at Five Big Shops

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American Machinist

Air-Cooled Cylinders for Franklins

These five articles deal with the methods of machining the engine cylinders for five different passenger automobiles. The first one takes up the problems encountered in handling the singly cast Franklin cylinders and points out the effects of the air-cooling feature. The boring heads, the method of holding, the flange-drilling fixture and other devices described are worth noting.

THE Franklin cylinder is one of the few which are now cast individually, this being done in order to secure proper cooling by the current of air which is used in the Franklin system. The cylinder has a square base and 52 vertical fins, as can be seen in the different illustrations. Fig. 1 shows the transformation of succeeding operations.

The cylinder is centered by the outside just below the flange by means of the swinging jaws, Fig. 2, which are pivoted at *A*, and when clamped in position, lock under the dovetail at the top of the main casting *B*. Three jaws *C* bear against the outer edges of the cooling fins, support what is the lower end of the cylinder in this operation, and preventing movement and distortion. The driving of the cylinder is also assisted by the dog *D*, which embraces one of the corners of the bolt flange, when the jaws are closed.

This operation consists in boring out the mouth of the cylinder and facing the bolt flange to the gage shown at *E*, this being done by the regular boring tools to be seen in the head of the vertical boring machine. The mouth is the locating point for the boring operation which follows. The cylinders are bored in the fixture shown in Fig. 3, the castings being centered by the plug *A*, through the bushing *B*, in the top of the fixture. With the cylinder thus centered and held square by the bolt flange which has been previously faced, it is clamped in position by hook bolts having nuts on the top as shown at *C*. The bottom support *D*, which is practically a bolt having a special ball head, as shown in Fig. 4, is adjusted to bear against the under side of the cylinder, thereby holding it against the downward thrust of the boring cutter. Screws *E* resist the turning effect of the boring bar.

The thin wall of the cylinder makes it advisable to take three cuts, the type of boring cutter shown being used for the purpose. The first of these bores to 3.125 in.; the second, to 3.2 in., and the finishing boring head, to 3.240, allowing 0.01 in. for grinding. Details of these cutting heads are shown in Fig. 5. Both views of the fixture, Figs.

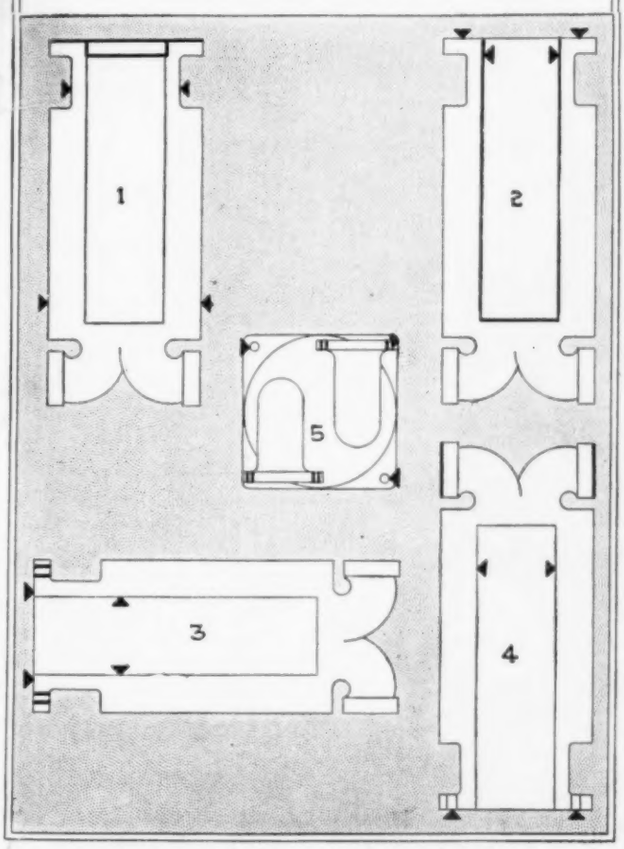

FIG. 1. TRANSFORMATION SHEET

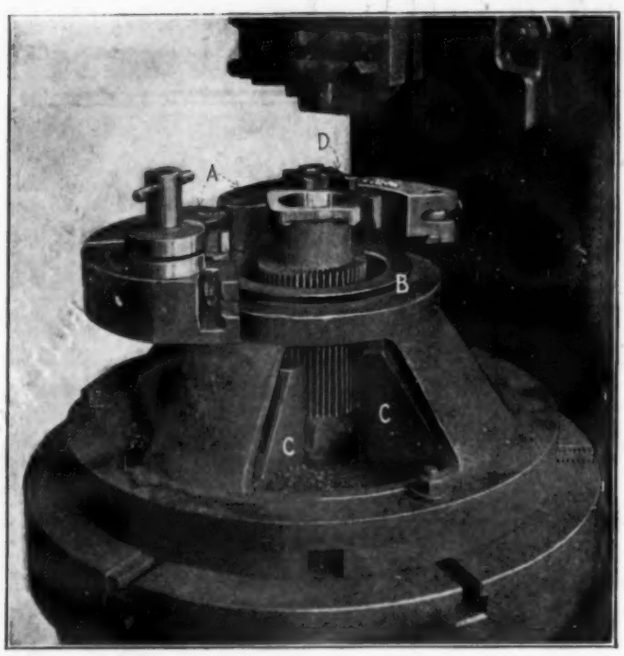

FIG. 2. FACING AND COUNTERBORING CYLINDER

3 and 4, will also show the screws *E*, which bear against the bolt flange at the corners, and assist in taking the thrust of the boring tools.

THE BEARING IS LARGE AND RIGID

The cutter shown in position on the spindle, Fig. 3, is for facing the top of the cylinder. Note should be made of the large and rigid bearing in which the boring spindle revolves, as this has much to do with the success of this operation.

The depth of the bore is determined by the stops *F*,

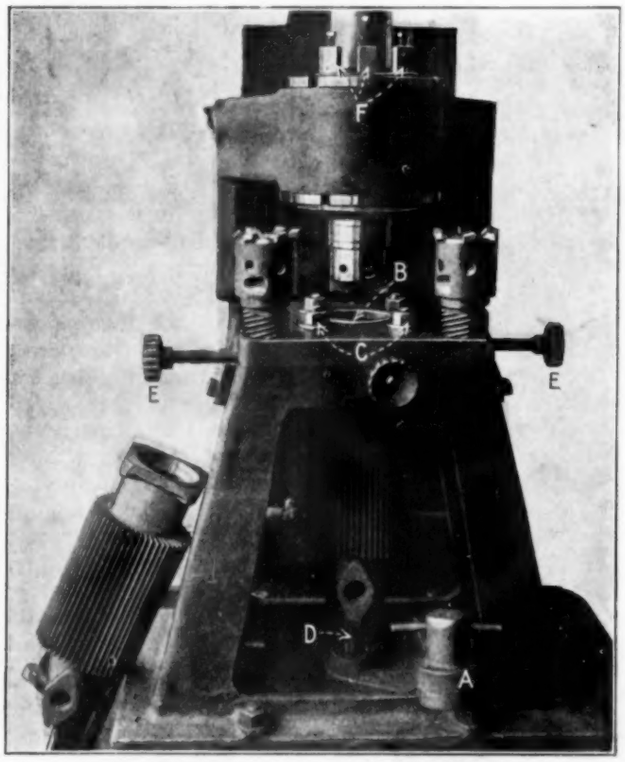

FIG. 3. BORING THE CYLINDER

which come in contact with a collar on the boring spindle when the cutter has reached the bottom of the bore. These are easily adjustable to take care of any variation in length of the boring heads.

The cylinders are then rough-ground in the regular

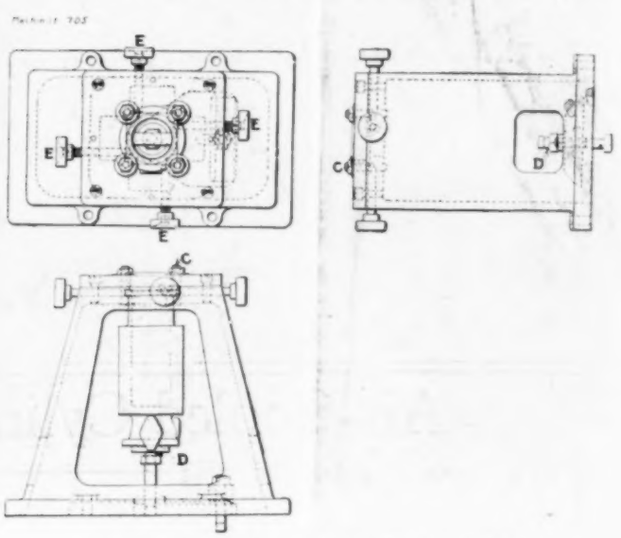

FIG. 4. DETAILS OF BORING FIXTURE

way, after which they pass to the special horizontal drilling machine, shown in Fig. 6. The cylinder is located on the pilot *A*, which is relieved on four sides, while the yoke *B* is swung down over it, and is held against the guide plate *C* by means of the screw *D*.

The four drills, driven by the special head shown, are then fed through the flange. On releasing the clamp *D*, the counterweight *E* brings the yoke up out of the way, allowing the cylinder to be readily removed, and a new one placed in position.

MILLING THE EXHAUST AND INTAKE FLANGES

The next operation, which consists of milling the exhaust and intake flanges and the top of the cylinders is shown in Fig. 7. The fixture holds 10 cylinders, two being removed to show the mandrels *A*, which take the cutter thrust, and the clamps *B* by which they are

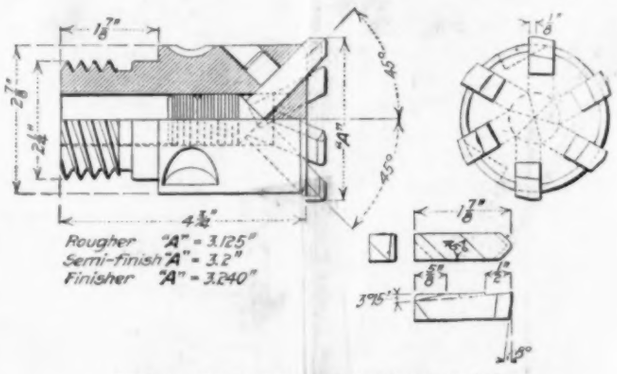

FIG. 5. DETAILS OF BORING HEADS

held. The cylinders are located by the bolt holes which were previously drilled in the flange. These fit over dowels, as shown at *C*. The clamps hold the cylinders in the fixture as seen at *D*.

Another interesting double fixture is shown in Fig.

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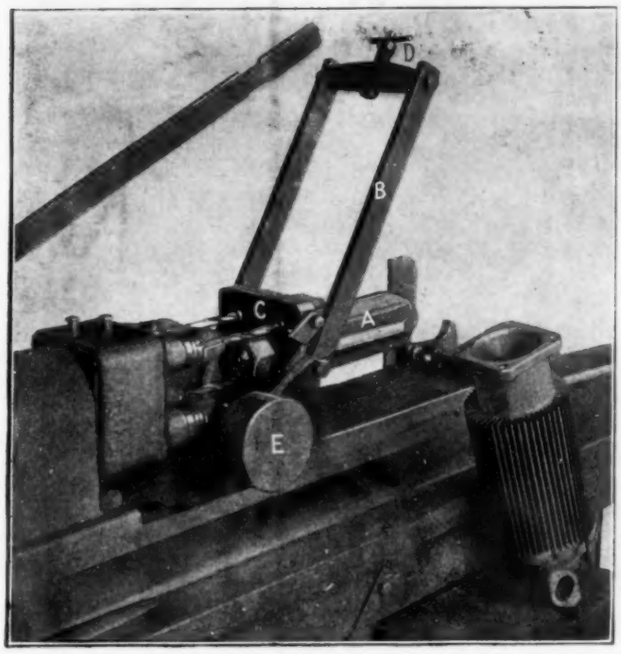


FIG. 6. DRILLING BOLT FLANGES

8, where the bolt holes in the inlet and exhaust flanges are being drilled.

This double fixture utilizes eight spindles of the multiple drilling machine shown, and shows how the bolt holes are used to locate the position of the flanges by means of the dowels *A*, the cylinder being held in position by the screw clamp *B*. The thrust of the drill is taken by the supporting pin *C*. The fixture is arranged so that one side drills the inlet, and the other side the exhaust flanges. The cylinders are removed from one side and simply transferred to the other after being turned half over.

The Finishing Touches

After the other holes are drilled, reamed and tapped, the outside diameters of the flanges are ground when necessary and the cylinder bore is then finish-ground.

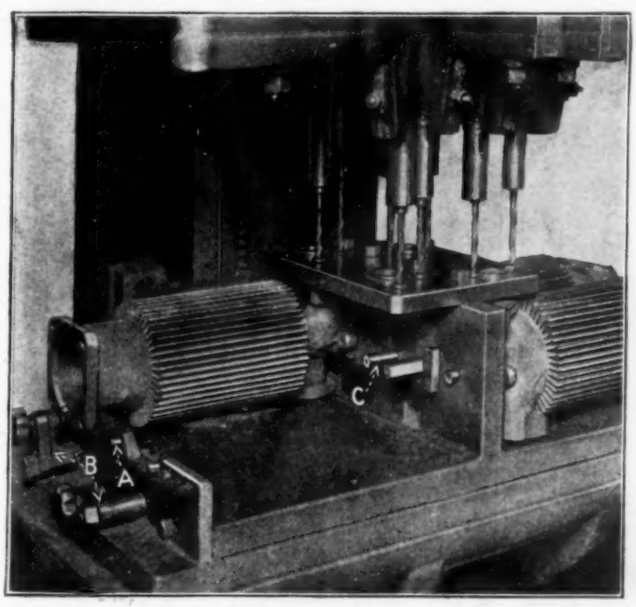


FIG. 8. DRILLING OUTLETS ON BOTH SIDES

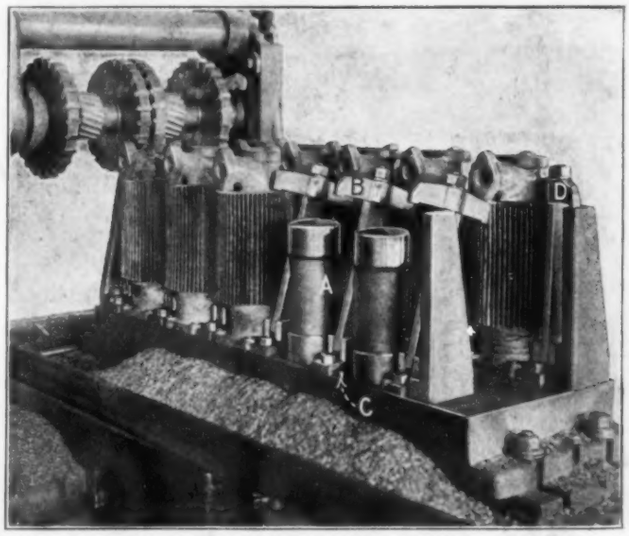


FIG. 7. MILLING INLET AND EXHAUST OUTLETS

The finishing touches are then put on the valve seats, and special care is taken to secure accuracy and uniformity of cylinders at all essential points.

Water-Cooled Cylinders for the Eight-Cylinder Peerless

Although the output of the Peerless Motor Co. is not large as compared with quantity production shops, the arrangement of the machines so as to avoid undue handling of material, and the methods employed, indicate that production costs have been considered.

The principal machining operations are shown in outline in the transformation sheet, Fig. 1, and in more detail in the halftone illustrations which follow. Fig. 2 shows the way in which the gang of cylinders are held on the milling-machine table, so that the top, bottom, and sides can be milled at the same time. In addition to this, an angular head has been added, as can be seen at *A*, for the purpose of milling the seats for the water connections to the cylinders. This view also shows some pin gages at *B* for testing the distance between some of the milled surfaces.

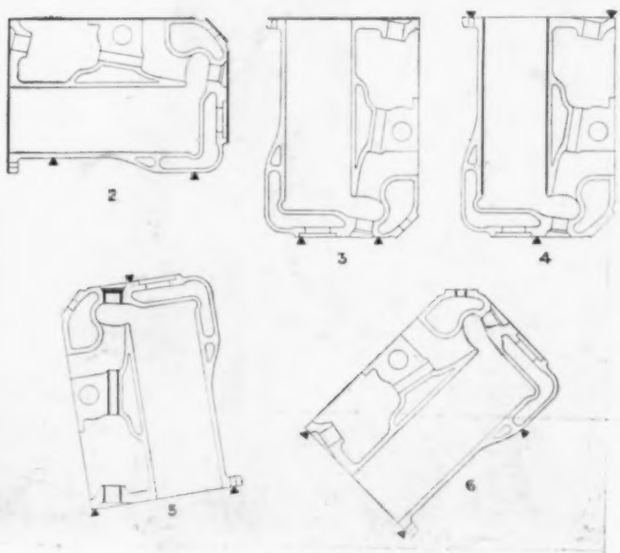


FIG. 1. TRANSFORMATION

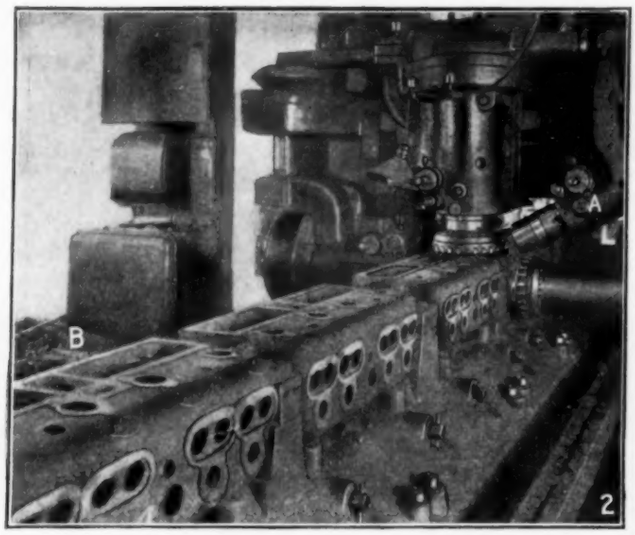


FIG. 2. MILLING CYLINDER BLOCKS

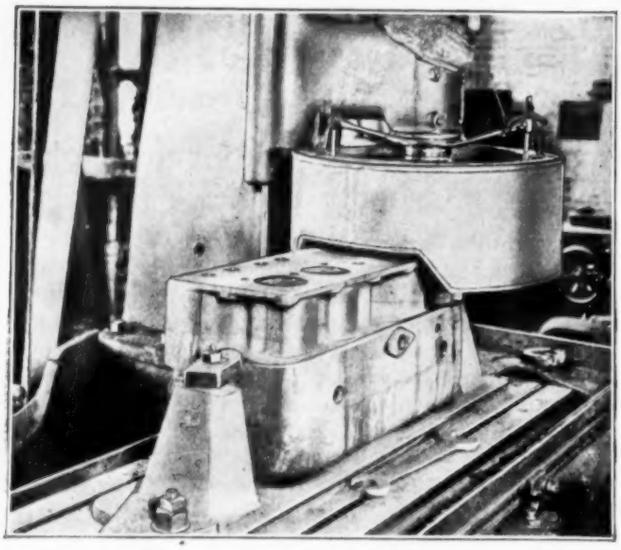


FIG. 3. GRINDING CYLINDER BASE

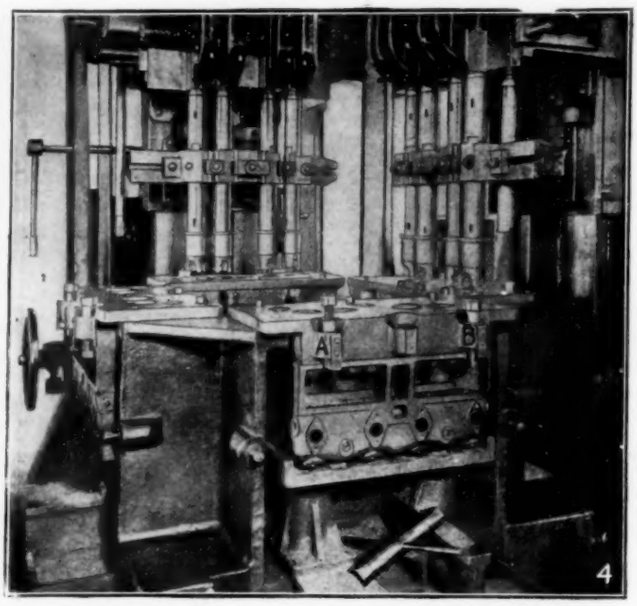


FIG. 4. BORING THE CYLINDERS

Before proceeding with the drilling and boring operations, the base flange of the cylinder is ground on the vertical spindle machine shown in Fig. 3. Here the cylinder is simply clamped to the grinding-machine table by means of the simple fixture shown, the upper milled surface being used for locating the flange squarely with the grinding wheel.

The boring is done on the special machine shown in Fig. 4, which carries two sets of four spindles each, set 90 deg. apart, so that one can be roughing while the other is finish-boring the cylinder which has already been bored, making it ready for grinding. This machine has a heavy and substantial table which can be readily revolved so as to bring the cylinder blocks successively under the proper set of spindles. The cylinders are located by bolt holes previously drilled on a multiple-spindle drilling machine, and the cylinder flanges are fastened to the upper plate of the boring fixture by means of the hook bolts *A* and *B*.

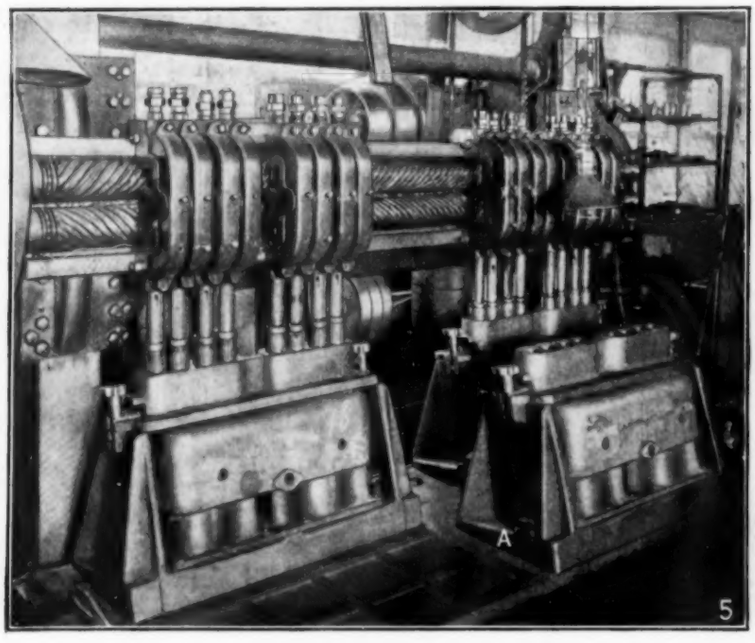


FIG. 5. BORING VALVE SEATS

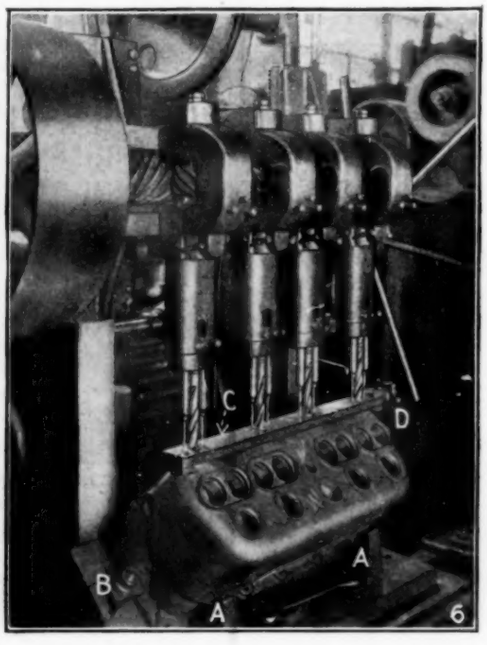


FIG. 6. DRILLING WATER OUTLETS

Then comes the boring of the valve seats on the type of machine shown in Fig. 5, which handles two cylinder blocks at the same time. This also shows an extra block with the cylinder in place so as to avoid lost time in handling the work to the different cutting machines. It will be noted both in Fig. 1 and in Fig. 5 that the valve stems and seats are not parallel to the bore of the cylinder, but are at an angle to it. This is taken care of by the fixture shown at *A*, Fig. 5, the base of this fixture giving the proper angle for the valve stem and seat.

Another interesting angular fixture is shown in Fig. 6, where the water outlet is being drilled by four spindles, while on each side of these is a small drill, drilling the holes which are soon to be tapped for the water-connection flanges.

In all of these cases the cylinders are located by means of dowel pins which fit the bolt holes of the base flange. The supporting arms *AA* make it easy to put the cylinder block in place, where it is held by the clamp *B*. The bar *C* which carries the drilling bushings is located by V-blocks on the under side and held by screw *D*.

The Packard Twin-Six Cylinder Blocks

The use of conveyors greatly facilitates the handling of cylinders in the Packard shop, while the use of multiple boring bars, which bore two blocks, of six cylinders each, at one setting, assists greatly in speeding production.

THE cylinder shops of the Packard Motor Car Co. are well equipped with multiple-bar boring machines, multiple drilling machines, and Matthews conveyors for handling cylinders from one machine to the next. This is equally true in both the passenger-car and truck motor shops. The sequence of operations is shown in Fig. 1.

These machines are for the most part of the horizontal type; Fig. 2, giving an idea of their size and general construction. Large square tables are used for holding the work, two cylinder blocks being held in position on each side, as can be seen. The men at the left load the fixtures, and afterward remove the cylinders when they have been faced and bored. This illustration also shows the conveyor system for handling the cylinder blocks. An idea of the details of these fixtures and the way in which one cylinder block is milled while the other is being bored may be seen in Fig. 9, which shows a machine in the truck cylinder shop.

The bolt holes are next drilled under a multiple machine as shown in Fig. 3. This also gives a glimpse of the boring machine at the left and shows how the conveyor handles the material from one machine to the next. The milled surface and the bolt holes locate the cylinders in future operations.

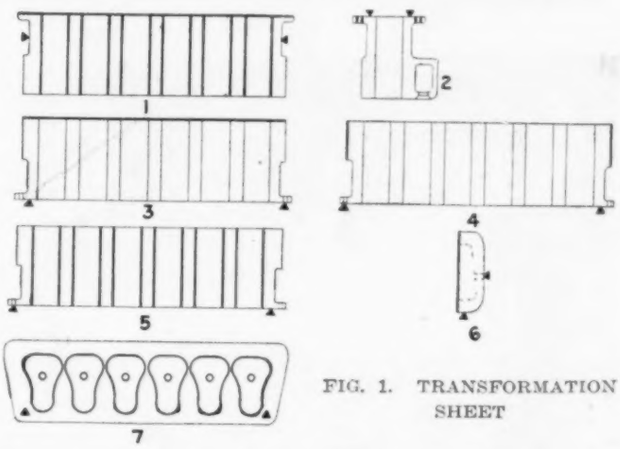


FIG. 1. TRANSFORMATION SHEET

The top and sides of the cylinders are next milled on machines of the planer type, gang cutters being arranged so as to finish all necessary surfaces. The rather

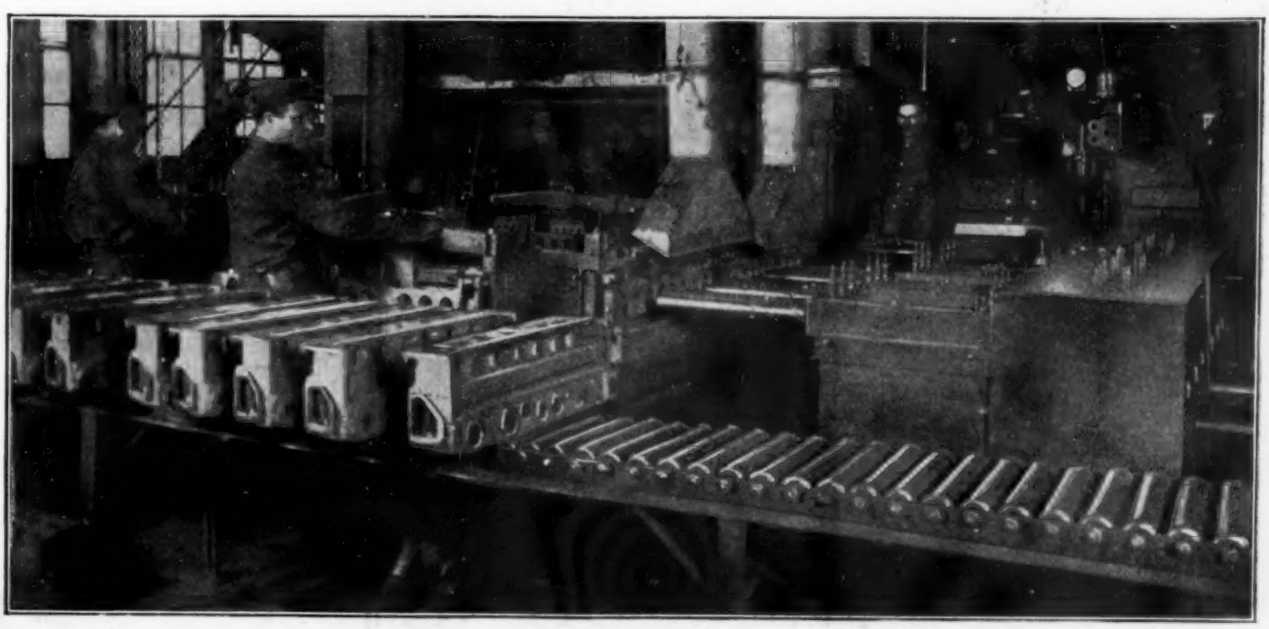


FIG. 2. MILLING AND ROUGH-BORING TWIN-SIX CYLINDERS

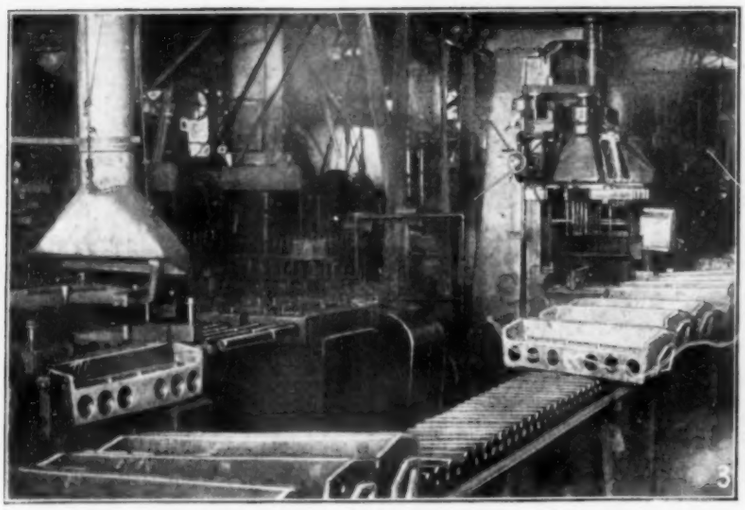


FIG. 3. MULTIPLE MACHINE DRILLING BOLT HOLES IN FLANGE

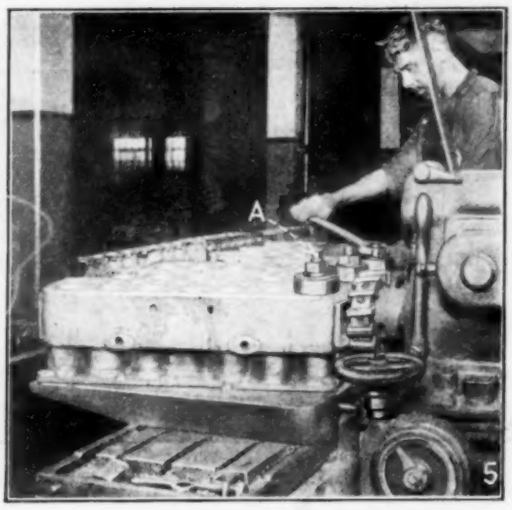


FIG. 5. MILLING THE ENDS OF THE CYLINDERS

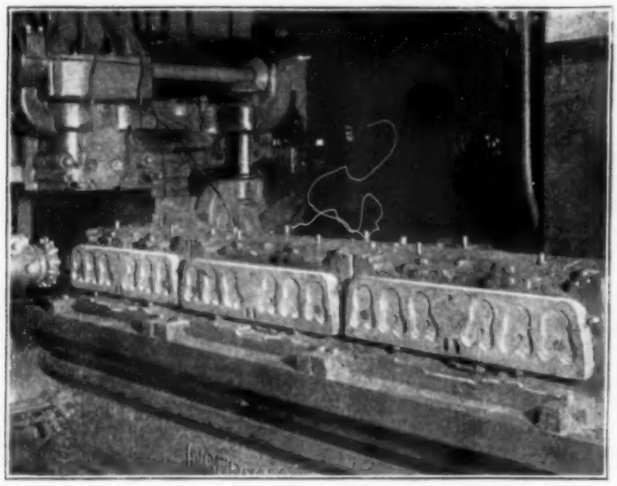


FIG. 7. FOUR-SPINDLE FACE-MILLING MACHINE FOR CYLINDER HEADS

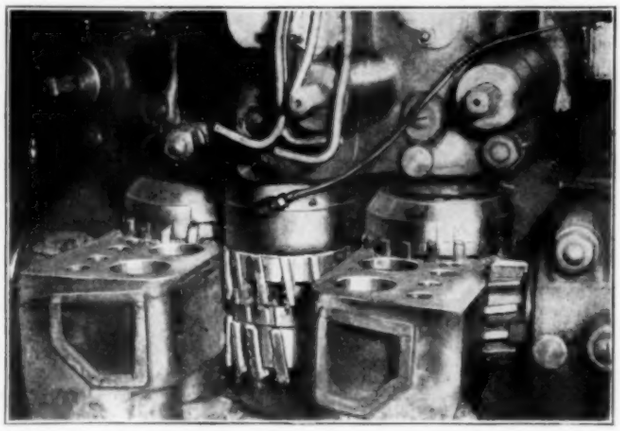


FIG. 4. MILLING TOP AND SIDES

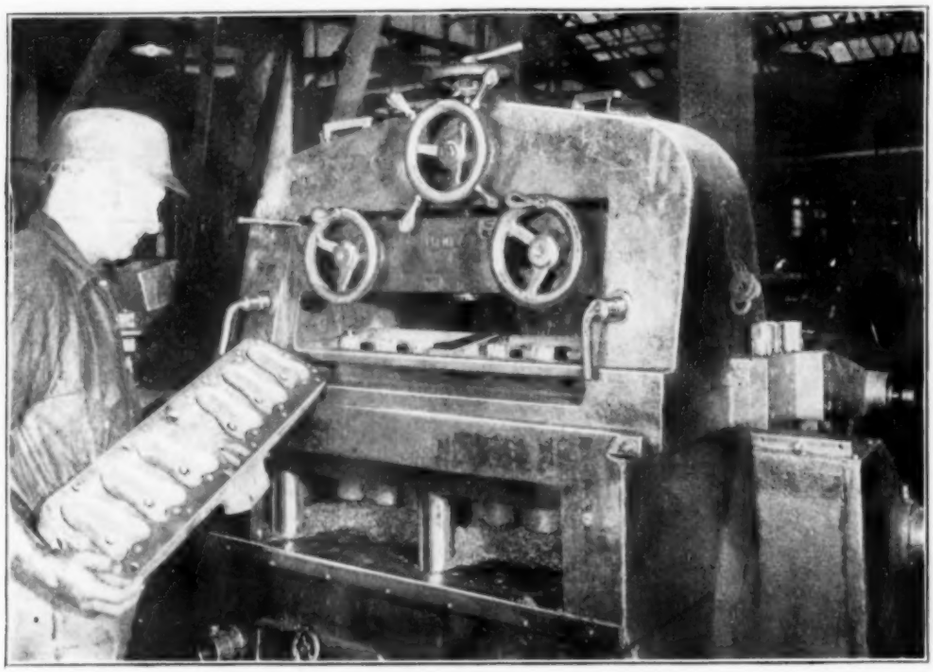


FIG. 8. PROFILING DOMES OF CYLINDER HEAD

unusual arrangement of milling heads is shown in Fig. 4. Then the ends are milled as shown in Fig. 5, on a heavy knee-type machine, the cylinder blocks each being located by suitable dowels and held in place by a stud and collar through the first hole as can be seen at *A*.

The mouths of the cylinders are then chamfered by suitable cutters in boring bars, and finally finish-reamed in the special machine shown in Fig. 6. A heavy fixture carrying four cylinder blocks is mounted on a square table, two of these blocks being operated on at the same time. Each set of reamers is at 90 deg. or forms two sides of a square, and each bar carries its own bushing as can be seen. Here again the conveyor system is in evidence and it will be noted that the round piece

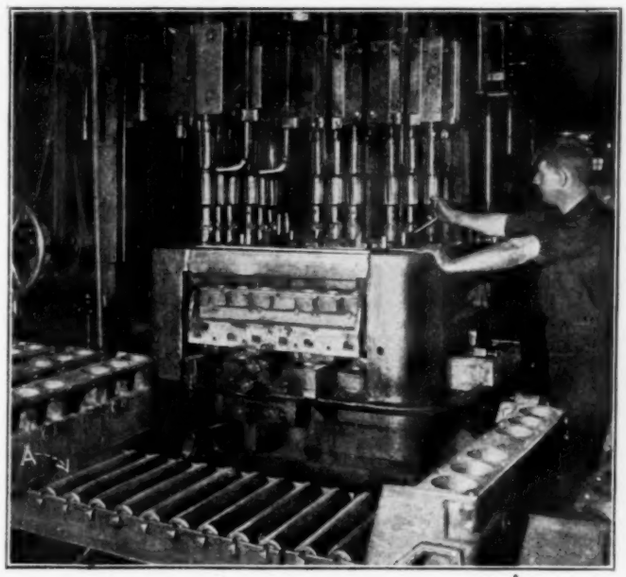


FIG. 6. FINISH-REAMING CYLINDERS

placed between the rolls at *A*, effectually prevents the cylinder blocks from moving on the conveyor until it is desired to have them do so.

The cylinders are afterward finished by grinding, an allowance of 0.012 in. being made for this purpose.

The cylinder heads are first drilled for the spark plugs, these holes being used in bolting them to the milling fixture shown in Fig. 7. This machine carries four spindles, two horizontal and two vertical, only the horizontal spindles being shown equipped with cutters. Six cylinder heads can be held horizontally on the top of the fixture, the studs for holding being plainly seen. Three additional cylinder heads are held on the other side of these fixtures making it possible to machine 12 at one setting.

In order to secure equal compression space in the cylinders, the dome for each is carefully profiled on a special machine shown in Fig. 8. The head, placed in position over the six cutters shown, is carefully located by dowels, clamped in position, and the machine started. By a special arrangement of cams on the back and gears

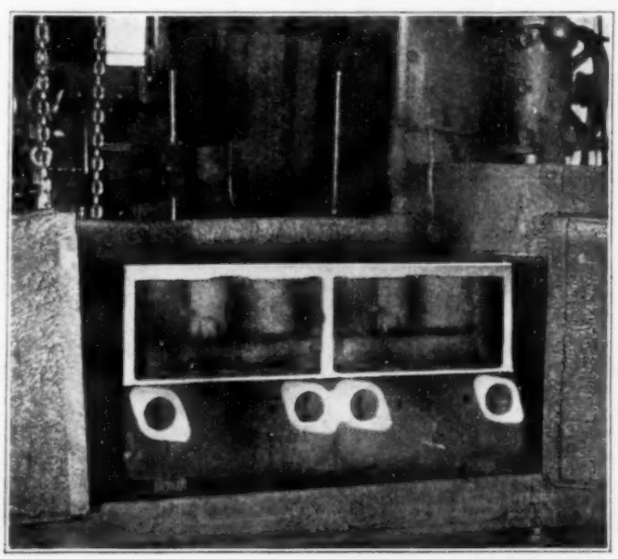


FIG. 11. GRINDING BASE FLANGE

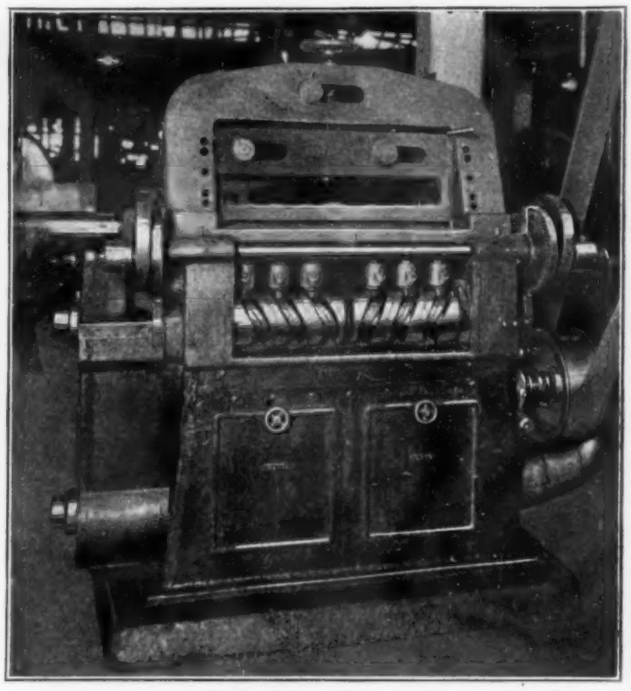


FIG. 9. DETAILS OF THE PROFILING MACHINE

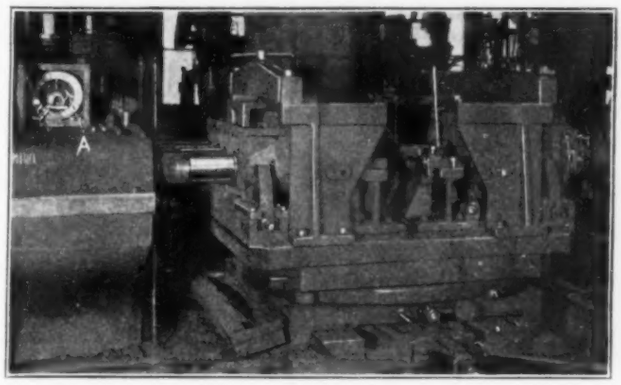


FIG. 10. FIXTURE FOR TRUCK CYLINDERS

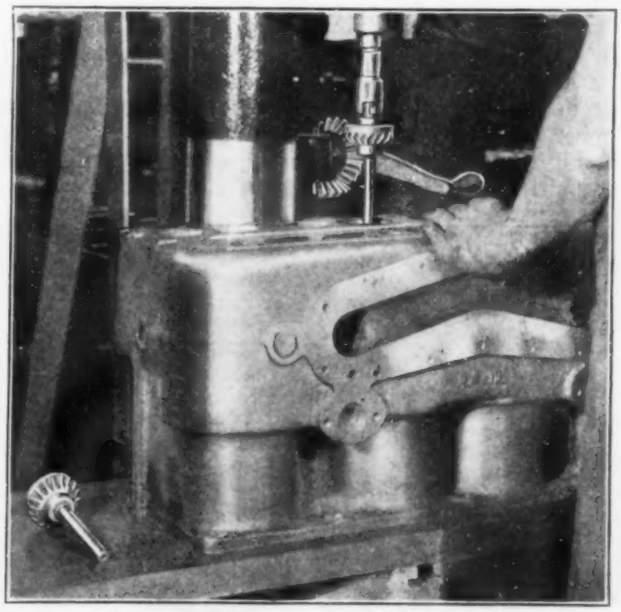


FIG. 12. MACHINING VALVE SEAT

at the sides of the machine, as shown in Fig. 9, the profiling cutters are moved sideways while the cylinder heads move back and forth producing the desired results.

Similar methods are used in building the Packard truck motor. Fig. 10 shows the fixture and machine for milling the base and rough-boring the cylinders at the same time. It shows the construction of the fixture and also shows the device used for testing the cylinder bore, this being kept in the box at *A*. The different clamping methods are well worth a careful study as much depends on locating the work in the first operation. Cylinders are then drilled and the face flange is ground as shown in Fig. 11. The cylinders are then finish-bored and reamed, after which the valves are seated as shown in Fig. 12, the large pilot fitting the valve opening, while the small one guides the reamer.

The Cylinders for the Cadillac Eight

Considering the size and cost of the car in question, the production in this factory is extremely large and the methods are worth careful study.

BEFORE the cylinder block is machined in any way, it is heat-treated, or annealed, after which two locating holes are drilled as the first operation. The block is then chipped and cleaned and goes to stock, from which it is drawn for the actual machining operation. The sequence of operations is shown in Fig. 1.

The first milling operation is shown in Fig. 2, where the base flange, the side, and the top of the cylinder block are milled at one setting. It will also be noted that by a special combination of milling cutters, the face of the manifold connection at *A* is milled at the same operation. It will also be seen that the proper setting of the milling cutters for the top and bottom faces is indicated by the dial gages *B* and *C*. After this, the bottom of the block is finish-ground under a vertical-spindle machine so as to present a true and smooth surface to the cylinder base, this being shown in Fig. 3.

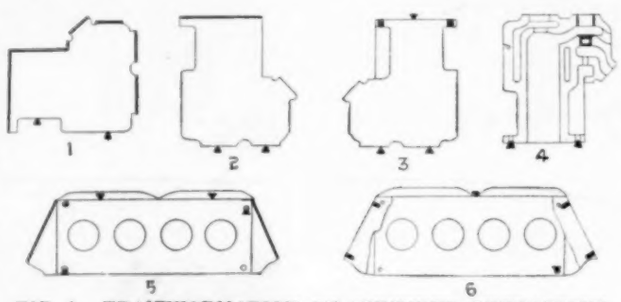


FIG. 1. TRANSFORMATION OF CYLINDER OPERATIONS

Next comes the drilling of all the holes in the base flange as shown in Fig. 4. It will be noted here that drills are set at various lengths so as to reduce the power required for drilling and also the pressure required. The drills in the center break through about the time those on the end are really getting down to work. The ground surface of the work is held against the upper plate of this fixture, the flange being clamped against the upper plate by cams operated by the handles *A* and *B*. The cylinders are bored in the usual manner, two cuts being taken, and they are also reamed ready for grinding. Then all the holes in the top and sides are drilled and tapped, the ends of the barrels chamfered, the holes counterbored, and the flange bosses spot-faced.

The next operation illustrated is the machining of the valve seat as shown in Fig. 5. Here again the cylinder block is located by the face flange with dowels in the bolt holes, and the swinging top *A* holds it firmly in place. The machine at the left drills the holes for the valve-stem guides, the drill guide bushings being shown at *B*. After the valve-stem bushing holes are reamed and the spring-seat bosses spot-faced, the angular ends of the cylinder blocks are milled in the special machine shown in Fig. 6 and then drilled in another special machine, Fig. 7. The cylinder is clamped against the angle plate *A*, Fig. 6, by means of two hooks *B* and *C*, these being operated simultaneously by means of the cross-bar *D* and the screw *E*. This makes a very quick-acting clamp and also one which holds the work effectively. The flange is, of course, located by dowels in the bolt holes.

The clamping fixture for the drilling operation is somewhat different, the arm *A*, Fig. 7, reaching over the cylinder block which is held by means of the shoe *B* forced into place by screw *C*. It will also be noted that these drilling heads carry their own guiding plates, as at *D* and *E*, so that it is only necessary to advance the drilling heads until the guide plates are set firmly

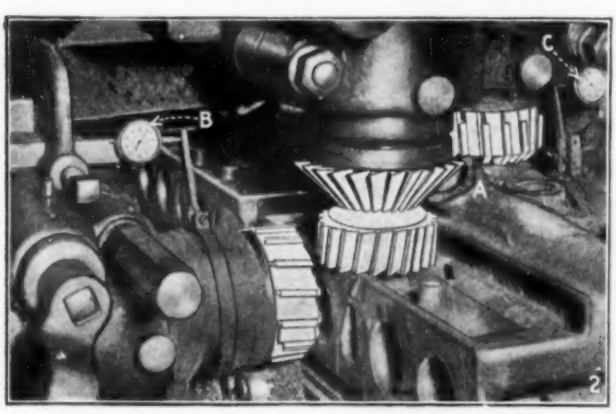


FIG. 2. MILLING TOP, SIDES AND BOTTOM

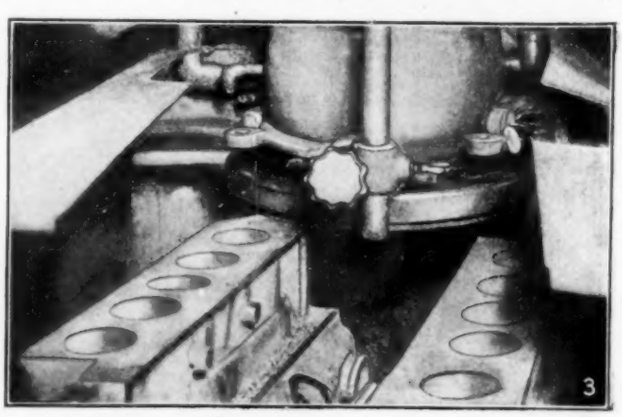


FIG. 3. GRINDING CYLINDER BASE

against the cylinder by the springs shown. The drills are then fed in to the required depth.

These holes are then tapped, the cylinders are washed, the bore ground, connecting-rod clearance cut on the side, and the cylinder block tested for water-jacket leaks in the fixture shown in Fig. 8. In order to close the angular openings on the end, special pads *A* and *B* are provided, these being both operated by the handle *C*, through the rods *D* and *E*. The cylinder block is held down in position by means of the upper strap *F*, and the double handle nut *G*. This makes an apparatus which can be very quickly handled, the gage shown at the right indicating the pressure applied.

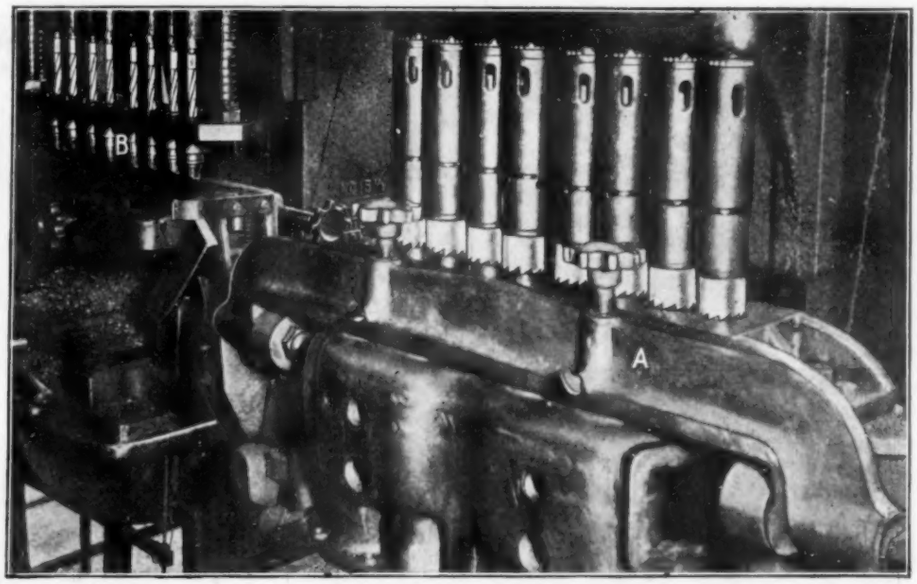
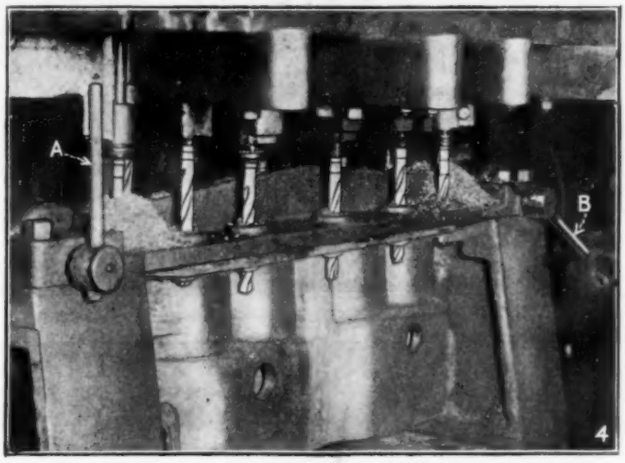


FIG. 5. MACHINING VALVE SEATS



IG. 4. DRILLING FLANGE BOLT HOLES

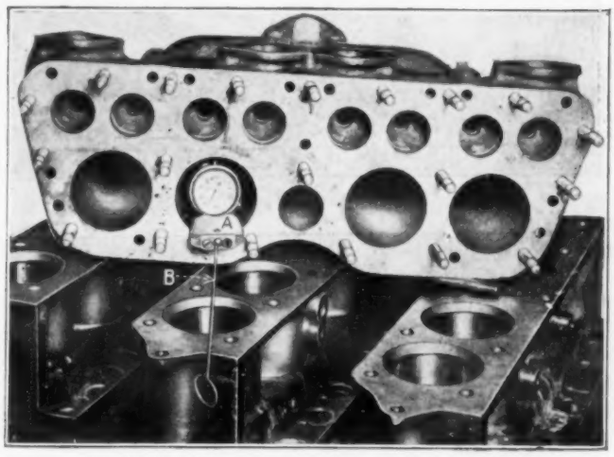


FIG. 9. MEASURING THE CYLINDERS

A dial gage is used in inspecting the cylinder bore as well as its uniformity of diameter from end to end. This arrangement is shown in Fig. 9. Here the dial gage is mounted on the block *A* which has two bearing strips on its lower side so that these, together with the point bearing on the gage, give a three-point contact. In order to handle this gage in and out of the cylinder bore without cramping it, and in this way securing a false reading, the handle *B* is connected to the base *A* by means of the ball joint shown. In this way it is practically impossible to cramp the gaging fixture as it is being pushed into the cylinder.

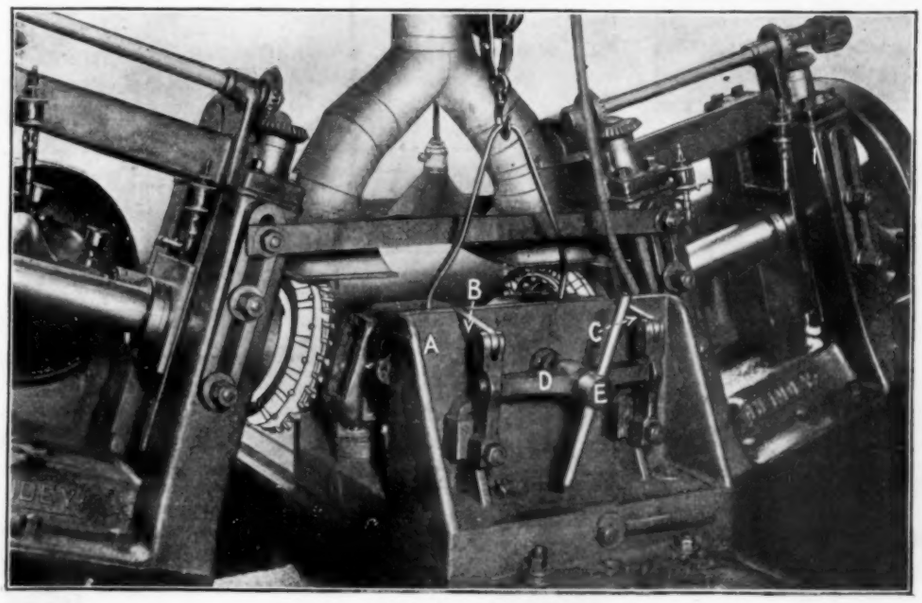


FIG. 6. MILLING ANGULAR ENDS

The main machining operations on the cylinder head are shown in the transformation diagram in Fig. 10. The bosses on top of the cylinder head are first spotted in a profiling machine, as can be seen in Fig. 11. The casting is held in position on the face of the fixture, which contains

FIG. 7. DRILLING THE END HOLES

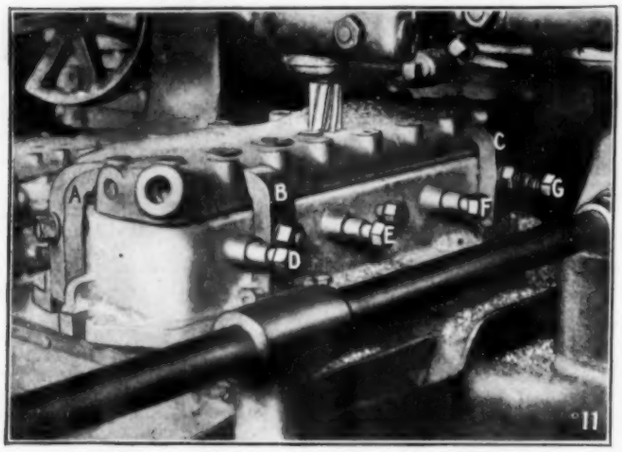


FIG. 11. SPOT-FACING LOCATION BOSSES

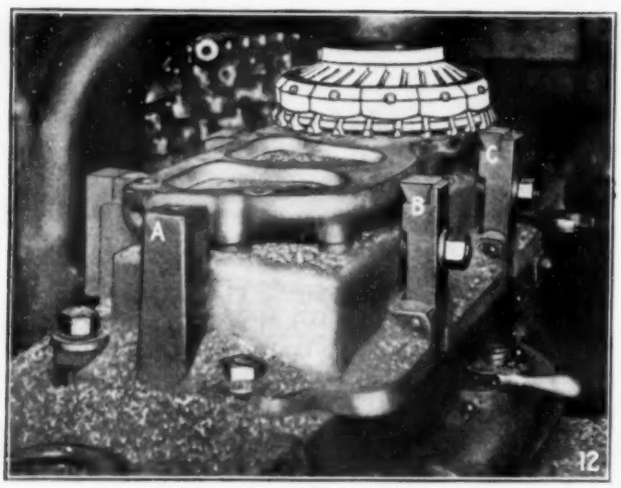


FIG. 12. MILLING FACE OF CYLINDER HEAD

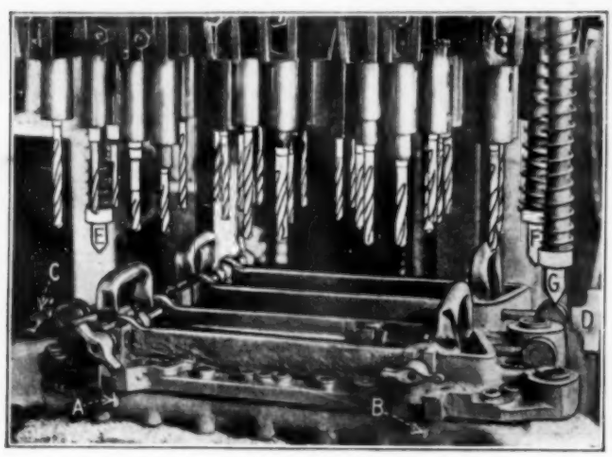


FIG. 13. DRILLING BOLT HOLES

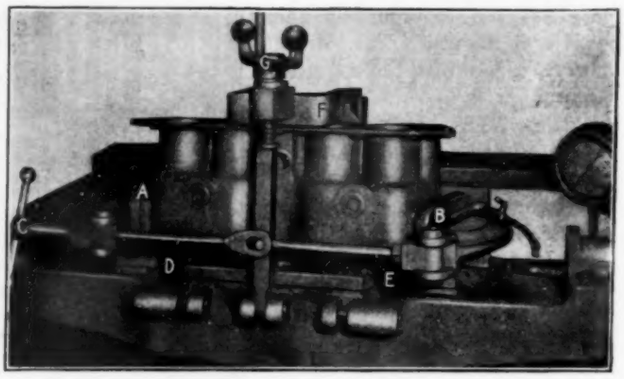


FIG. 8. WATER-TESTING FIXTURE

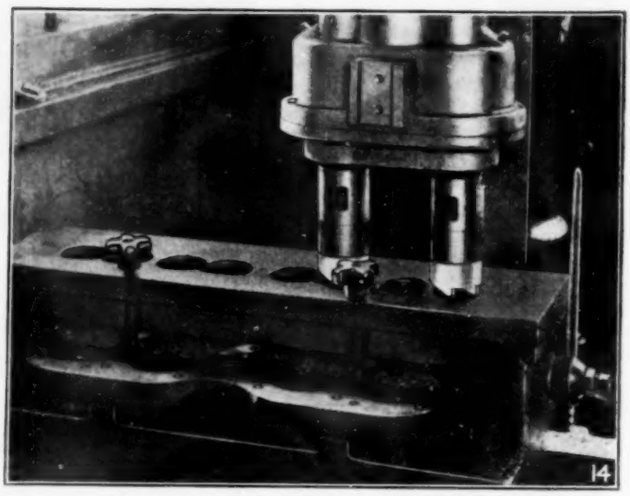


FIG. 14. ROUGHING OUT COMPRESSION SPACES

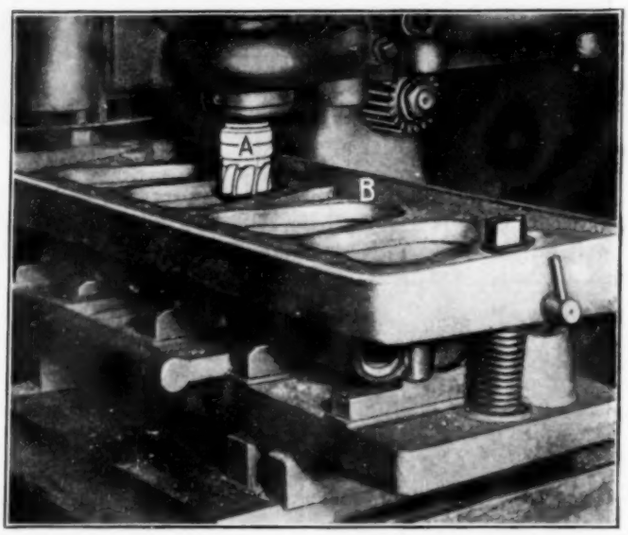


FIG. 15. FINISHING ON PROFILING MACHINE

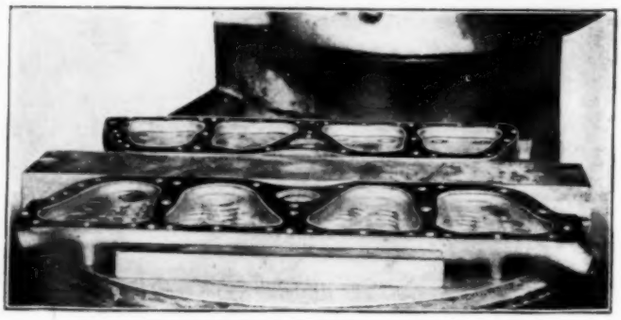


FIG. 16. GRINDING CYLINDER-HEAD JOINT

raised points to secure an even bearing, by means of the wedging clamps shown at *A*, *B* and *C*. The points on which the castings rest can be raised or lowered by means of screws *D*, *E*, *F* and *G*, so that inequalities in the casting can be readily taken care of.

Resting the cylinder head on the points which have been faced, the next operation faces the joint in a vertical milling machine with the large, inserted tooth cutter shown in Fig. 12. Here, too, the wedging type of clamp jaw is used, three of these being shown at *A*, *B* and *C*.

Next is the drilling of the bolt holes through the cylinder head, the head being held in the portable fixtures shown. These fixtures carry two heads and are held to the heads themselves by the wedge clamps *A* and *B*, Fig. 13, the clamps on the other side being operated by means of screws *C* and *D*. These drilling fixtures are located under the multiple spindle drilling machine by means of the spring-actuated pilots *E*, *F* and *G*, a fourth pilot being at the left but hardly distinguishable behind the drills.

The next operation is to machine the compression spaces in the cover, the second stage of this being shown in Fig. 14. Here double circles are faced by means of the special double-spindle boring head and the guiding plate shown which locates the bars in their proper position.

Then the profiling machine comes into play, as shown in Fig. 15, the cutter being guided by the roller *A*, working in the former plate B. This secures uniform compression space in all cylinders.

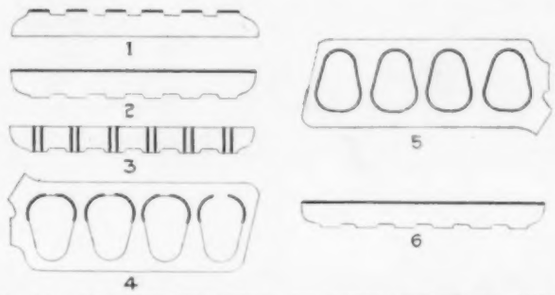


FIG. 10. TRANSFORMATION OF OPERATIONS ON HEAD

The final operation is the finish-grinding of the flat surface, on the Blanchard machine shown in Fig. 16. This fixture carries two cylinder heads and a magnetic chuck, enabling the work to be handled rapidly and accurately.

The Chandler Cylinder

These methods include the use of pneumatic fixtures, indexing fixtures, special tools for recessing the upper end of cylinder and for boring connecting-rod clearance, as well as an inspection device for cylinder bores.

THE machining of the three-cylinder blocks for a Chandler six-cylinder car includes a number of interesting operations, beginning with the milling of the tops and bottoms of the cylinders and the sides containing the valve-stem bushings and exhaust openings, as in Fig. 2. The transformation, Fig. 1, shows the sequence of the operations. Following the milling is the drilling of the holes for the inlet and exhaust flanges, as is usual, and a counter-boring in the dome, as this motor does not have a removable cylinder head. Then comes the rough-boring as shown in Fig. 3, the two cylinder blocks being operated on at the same time. The cylinders are positioned by their flanges and bolt holes and are held in position by the wedges *A*, *B*, *C* and *D*,

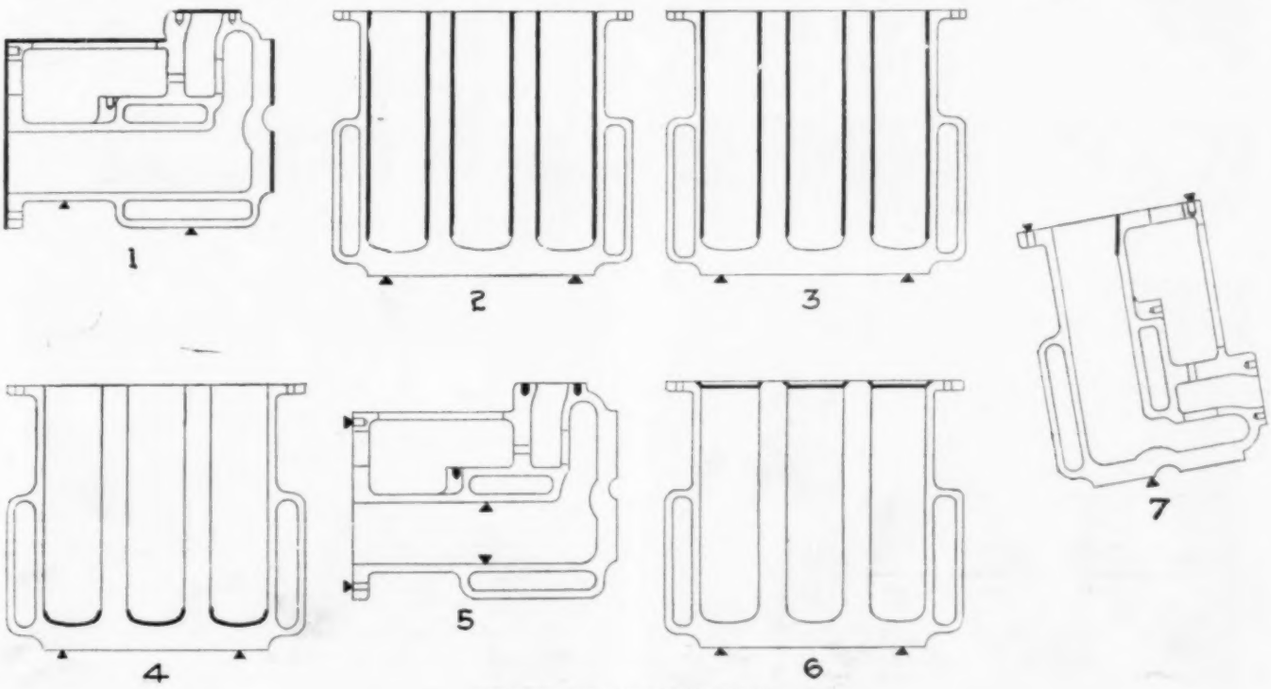


FIG. 1. TRANSFORMATION

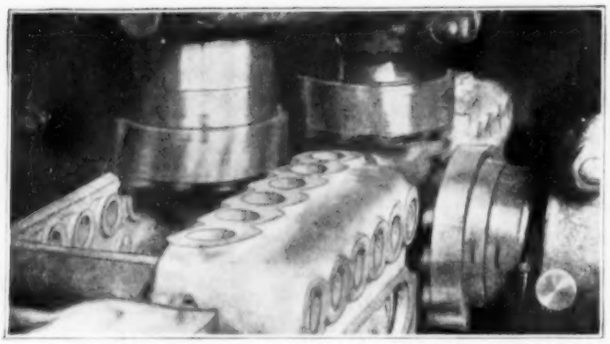


FIG. 2. MILLING THREE SIDES OF CYLINDER BLOCK

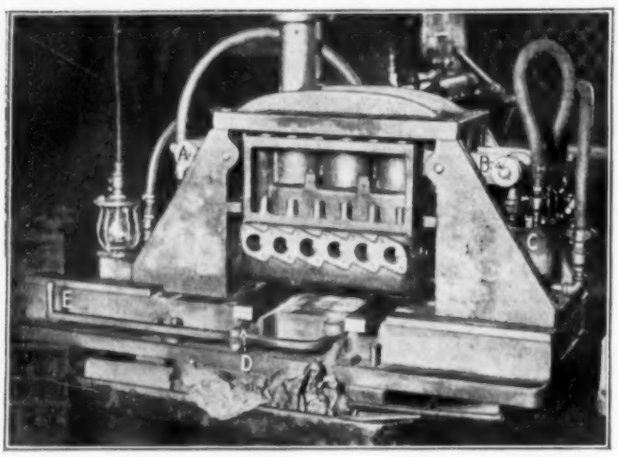


FIG. 4. PNEUMATIC FIXTURE FOR FINISH-BORING

operated by the adjoining handles. The center handles control another clamp at the back, and altogether this makes a boring fixture which is very readily operated.

A somewhat different fixture is shown in Fig. 4. The details of this fixture are given in Fig. 5. This is a pneumatically operated fixture, in which the cylinder block is firmly held by the arms *A* and *B*, operated by cylinder *C*. The pressure being applied at the top of the cylinders pulls the levers down, forcing the cylinder block up against the under side of the fixture. This fixture is used under a heavy single-spindle drilling machine and each of the three cylinders in the block is indexed in proper position by means of the pin *D* controlled by the handle *E*. The hose provide sufficiently

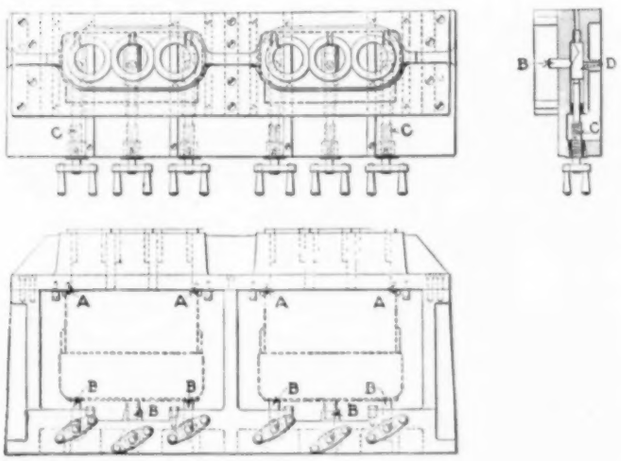


FIG. 6. FIXTURE FOR BORING PUSH-ROD HOLES

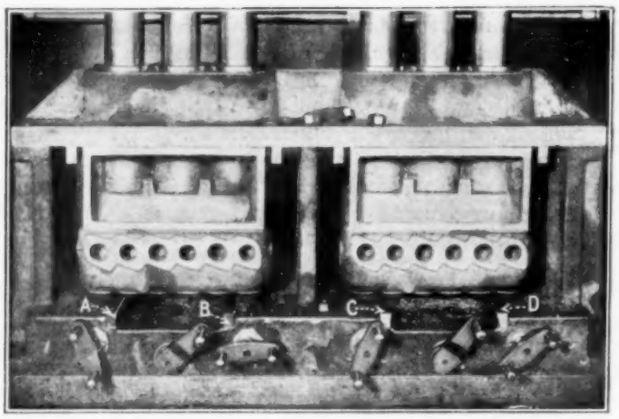


FIG. 3. ROUGH-BORING TOOL BLOCKS IN DOUBLE FIXTURE

flexible connections to the air supply to enable this movement to be easily made.

How the Pneumatic Fixture Is Made

Details of this fixture can be seen in Fig. 5, which shows the locating dowel pins *F* at the top, all the other parts being lettered to correspond with Fig. 4.

The fixture used for boring push-rod holes is shown in Fig. 6, this being a double fixture somewhat similar to that used for rough-boring, and shown in Fig. 3. The cylinders are located from bolt holes by means of the dowels *A*. The cylinder is held in position against the upper plate by means of the pins *BB*, which are forced up by the screw *C* operating against the wedge *D*. This makes a very substantial fixture, but is not quite as rapid in action as the one previously shown.

In Fig. 7 the dome of the cylinder is being faced to a given depth, this being determined by the ball collar *A*. This is also done on a single-spindle machine, but no in-

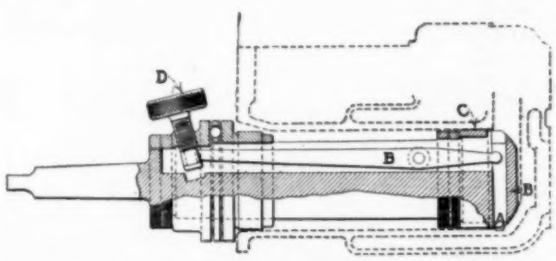


FIG. 8. RECESSING TOOL FOR CYLINDER

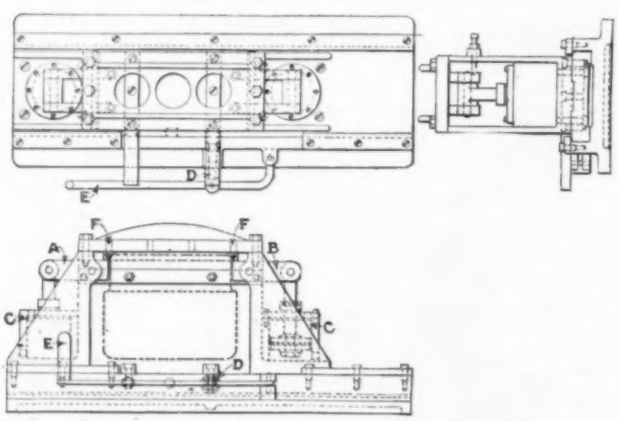


FIG. 5. DETAILS OF PNEUMATIC FIXTURE

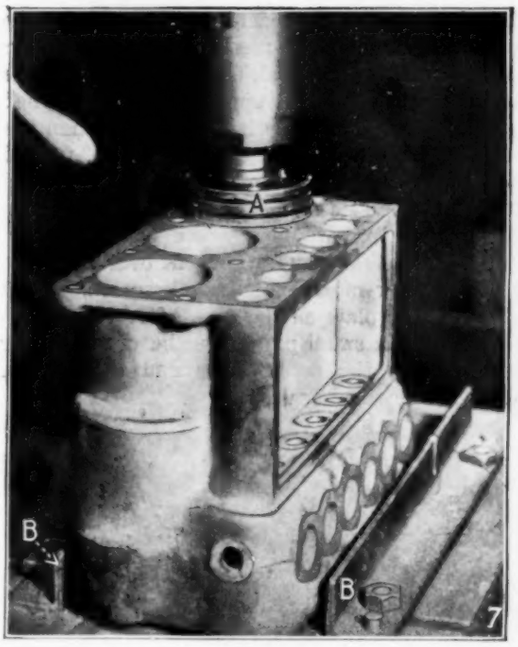


FIG. 7. FACING INSIDE THE CYLINDER DOME

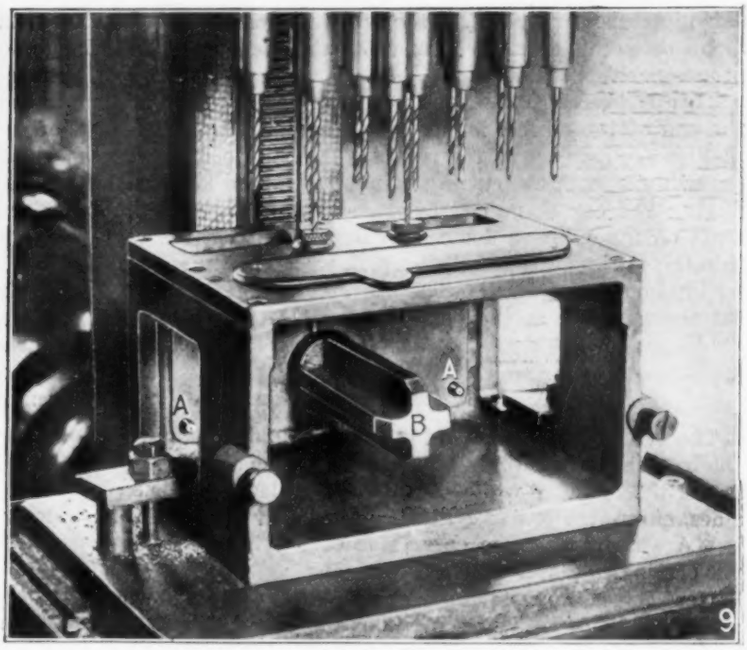


FIG. 9. FIXTURE FOR DRILLING EXHAUST BOLT HOLES

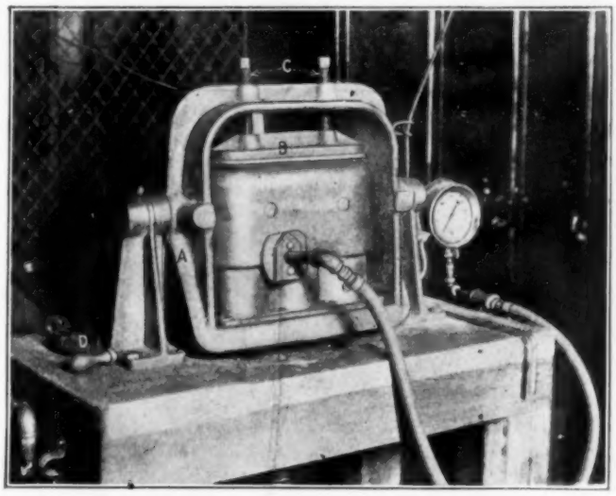


FIG. 10. THE WATER-TESTING FIXTURE

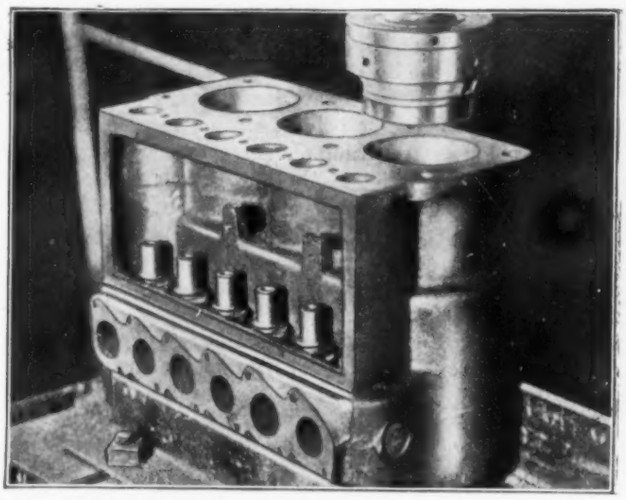


FIG. 11. CHAMFERING LOWER END OF CYLINDER BORE

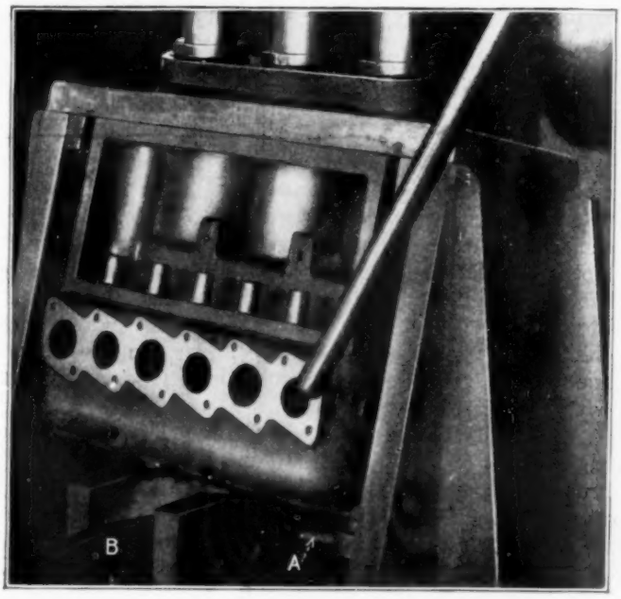


FIG. 12. BORING FOR CONNECTING-ROD CLEARANCE

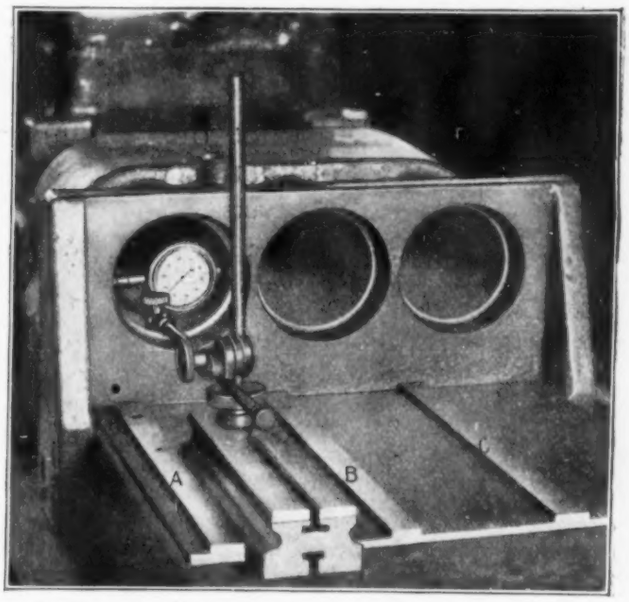


FIG. 13. METHOD OF INSPECTING CYLINDER BORE

dexing fixture is required, as the cylinder is easily moved along between the angle irons *BB* until the bore is in proper position.

Then the recess, to allow the overrun of the piston at the end of the stroke, is cut by the special tool shown in Fig. 8. This shows the recessing tool in position in the cylinder with the cutting point *A* advanced into the work. The bar *B*, guided by the sleeve or bushing C, seats on the cylinder dome and the tool *A* then is fed into the cut by means of the lever *B*, which is controlled by the knurled screw *D*. The operator can easily turn the screw handle as the tool revolves and the recess is readily cut in the desired position, and to the required depth.

Drilling Holes for the Manifold

The drilling of the holes for the manifold is done in the box jig shown in Fig. 9. Here again the dowels *AA* locate the cylinder while the pilot *B*, relieved on four sides, enters the center cylinder and acts as support for it. A strap across the outer side of the fixture holds the casting in place.

Next comes the water test for which the device shown in Fig. 10 is used. This consists of the pivoted cradle *A* and the plate *B* held in position by screws *C*, these being easily handled by the crank wrench *D*. This fixture allows the cylinder block to be swung in any position for examination. There is a pressure tank beneath the stand on which the cradle rests.

The cylinder bores are chamfered by the cutter shown in Fig. 11, the cylinder being held between angle irons as in the previous operation shown in Fig 7. Then comes the boring or relieving of the side of the lower end of the cylinder for connecting-rod clearance, utilizing the fixture shown in Fig. 12. The cylinder block is located by dowel pins as before, and held in position by jack-screws as at *A*. The lever *B* assists in placing and removing the cylinder block in the fixture. The three boring bars shown cut out a sufficient segment from one side of the bore to allow connecting-rod clearance.

Combination Surface and Dial Gage

After the cylinders are ground, the combination surface and dial gage shown in Fig. 13 is used for determining the diameter and straightness of the bore. The three hardened strips *A*, *B* and *C* guide the base of the indicating fixture in its movement. This makes a quick method of inspection, and one which has been found satisfactory.

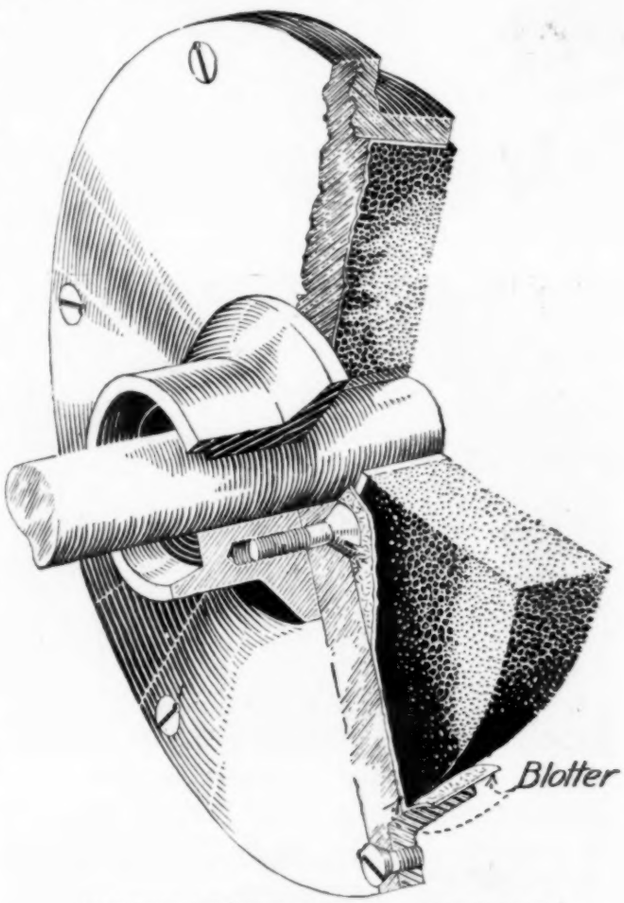
Adapter for Using Side of Grinding Wheel on Regular Stand

By H. H. Parker

While this is not to be construed as favoring the practice, for certain reasons it is sometimes desired to use the side instead of the face of a regular straight-face grinding wheel, perhaps when disk or cup wheels are not available. It is not at all satisfactory to use the side of a wheel as ordinarily mounted on the grinding stand; however, the illustration shows an arrangement by which it may be properly held, though in most cases the spindle would have to be cut off flush with the plate in order to make the whole side of the wheel effective.

A steel or iron plate, a little larger in diameter than the wheel to be used, is turned up, bored to a push fit on the spindle and attached to the rear wheel flange by three flathead countersunk machine screws. If the flange does not fit the spindle snugly it would be better to make a new one, or to bush it and re-bore. The plate should be carefully trued up and a groove turned off of one edge, leaving a boss slightly smaller than the wheel diameter. A tapered flange is made up, turned from either a steel or iron ring forged to shape and machined all over, or else cast from a wood pattern in tough bronze. Cast iron would not be dependable.

The ring flange should make a push fit over the plate and is held by six or more countersunk screws put in from the back of the plate as shown. After the screws are turned in tight, a small punch can be used to burr over the metal into the screw slots and this should prevent them from working loose.



HOLDING A WHEEL TO GRIND ON THE SIDE

Before fastening the ring for good, the face of the wheel is beveled off, by means of a grinding-wheel dresser, to correspond to the inside bevel of the ring; the final diameter should be such that, with a layer of blotting paper between the wheel and ring, the side of the wheel will project about $\frac{1}{8}$ in. beyond the side of the ring. Another blotter is placed between the back side of the wheel and the plate and when the screws are tightened the wheel should be held securely but without excessive pressure.

As considerable weight will be added to the revolving portion of the stand, the parts should be carefully trued and balanced before putting the apparatus into use. As the side of the wheel wears down near to the ring, the wheel may be taken out, beveled again and replaced, using enough packing back of it to allow it to project the desired amount.

Making Forged High-Speed Twist Drills

By J. V. HUNTER
Western Editor, *American Machinist*

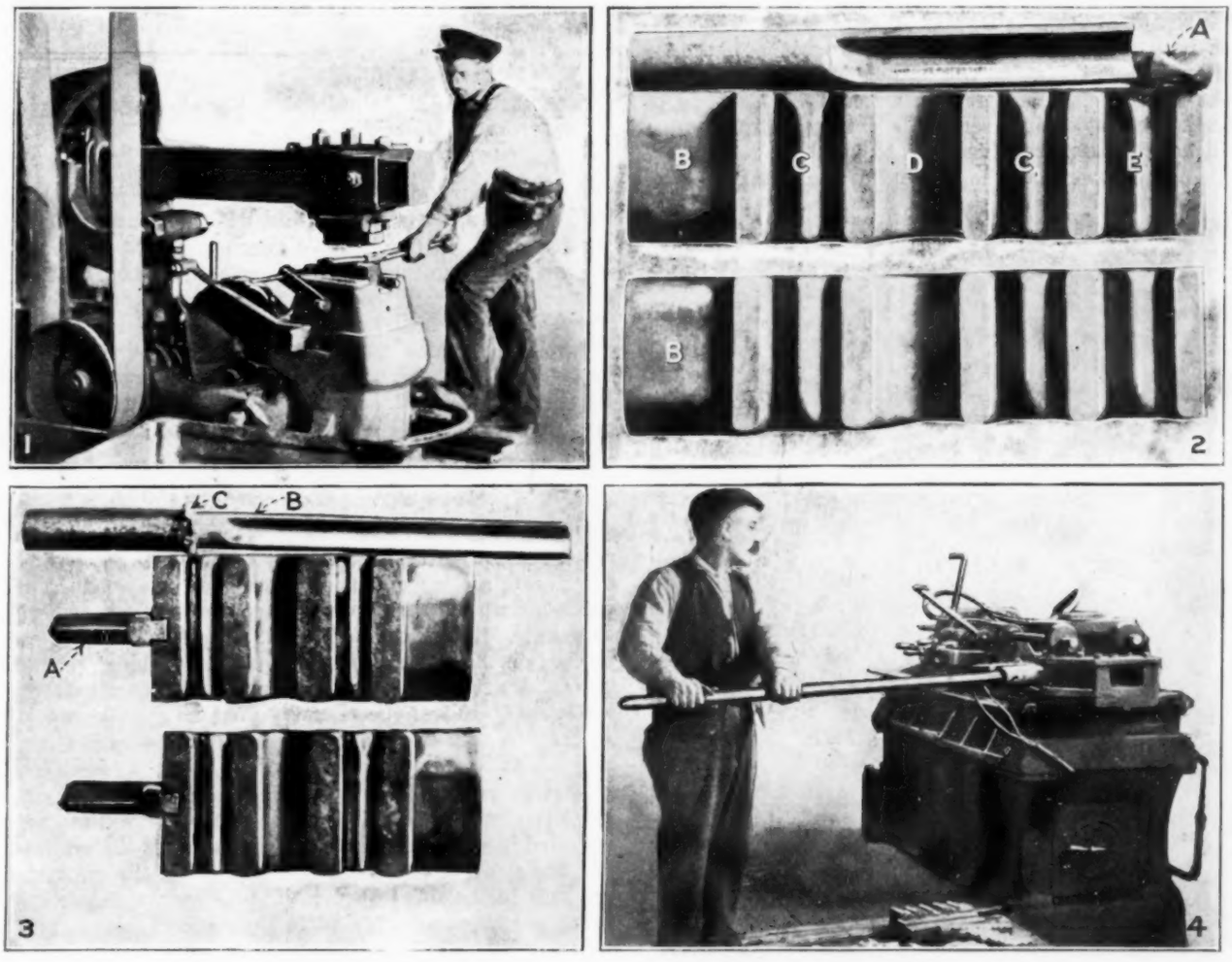
Very little has been generally known regarding the methods employed in the manufacture of forged high-speed twist drills, and the following article which describes and illustrates the methods used by one concern in its manufacture should be of interest to all users of that class of tools.

DURING the past few years tools of all kinds were in urgent demand and consumers found it difficult to obtain supplies to take care of their own needs. One user, the Ketler-Elliott Erection Co., Chicago, Ill., organized its own shops for the manufacture of small tools, and later has expanded its facilities to produce tools on a commercial basis. Among its products, forged high-speed twist drills are now being turned out in considerable quantities.

It has been observed by many manufacturers and users of high-speed steel tools that the cutting properties and life of the steel are noticeably improved by hot-working with proper forging methods before the tools go to the finish-machining operations. The drills are forged from round stock of a diameter suitable for machining the shanks without waste. The bars are cut to lengths that will be sufficient to make a single drill.

The forging operation, Fig. 1, is handled under Bradley hammers by expert operators who, while they forge the blanks very rapidly, are possessed of the requisite skill to handle the work without risk of injury to the steel. The blanks are heated to the correct forging temperature in oil furnaces, but few pieces being heated at a time so that each shall receive sufficient attention that there will be no danger of overheating.

With the heated blank held in his tongs the operator rapidly subjects it to the hammer blows, passing it back and forth through dies, such as are shown in Figs. 2 and 3, until the correct shape of groove, which can be seen at *A*, Fig. 2, is formed. There are several passes in these dies which are used to break down the stock and partly shape it before the finishing pass is used. The first blows on the blank, when working with the dies shown in Fig. 2, will flatten it slightly for the required length between the die passes *B*. The blank is then



FIGS. 1 TO 4. FORGING AND WELDING OPERATIONS

Fig. 1—Forging a drill blank. Fig. 2—Forging dies and a forged blank. Fig. 3—Forging dies and a blank showing the welding fin. Fig. 4—Butt-welding shanks

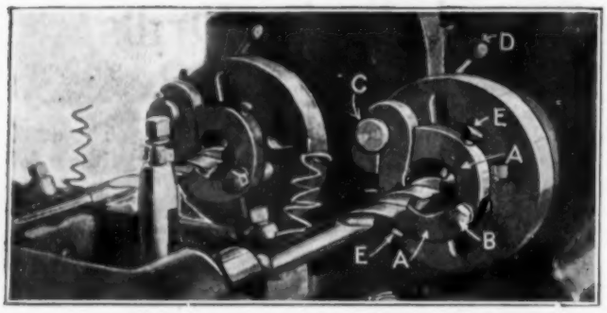


FIG. 5. TURNING DRILL SHANKS ON A DUPLEX LATHE

passed several times through the groove *C* which is shallower than the finishing groove, and between each pass it is rolled in the round pass *D*, which is the exact diameter of the desired forged section. Lastly, it is worked several times through the pass *E* which indents the groove to the final depth, being alternated each time through the pass *D* until the final form is completed. The entire operation is usually so rapid that a drill will be completely forged at a single heat without danger of working at too low a temperature.

Many of the dies are provided with hot chisels such as *A*, Fig. 3, by which the end of the forging may be clipped off at a single blow of the hammer. After forging, the drills are annealed by placing them in a box of mica powder.

In the drill forging *B*, Fig. 3, high-speed steel stock has been used up to the point *C*, which shows the fin thrown up at the point where an alloy-steel shank has been butt-welded on. It is claimed for this type of shank that superior strength is obtained at the tang, which will lessen the tendency to break at that point. It is also claimed that the welding of the shank does not decrease its strength because the area at the point of weld is so much greater than the area of the fluted section that any breakage will always be in the smaller section. The saving of costly high-speed steel which is thus effected is of interest to both the maker and the consumer.

The welding operation, Fig. 4, is carried out on a Federal welding machine. Special effort has been made to assure the thorough training of the welding operators to obtain the best possible skill in making perfect welds. After inserting the pieces to be welded in the holding dies, the operator usually strikes an arc several times, so that the heat will reduce any projecting high spots,

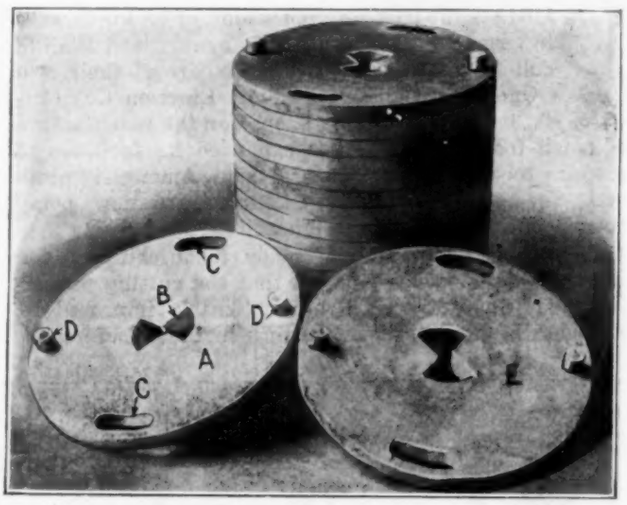


FIG. 7. PLATES USED IN TWISTING MACHINE

and thus insure that when the final pressure for the weld is put on, the pieces will be uniformly heated.

After heat-treatment and box-annealing of the forgings to insure softness for easy machining, and to further refine the grain they are transferred to the machine shop. Here the shanks are centered and, with the drill end held in female center and clamped by a special dog, the shanks are turned in a Schmidt-Norgren duplex turning lathe, Fig. 5. The use of this lathe permits the operator to handle two spindles at one time, using one to make the first cut on the taper shank, and the other to turn to size ready for grinding. As each tool is set for one operation it is only necessary to make adjustments for tool wear. Sufficient stock remains on the shanks after turning so that there will be ample for grinding after certain other operations have been completed. The quick-acting clamping dogs used have been devised especially for this class of work. The two arms *A* are pivoted on the center *B* while their short ends surround the camshaft *C*. A quarter turn of the camshaft by the lever *D*, causes these arms to firmly grip the work. As may be seen these dogs can be adjusted within certain limits by turning the setscrew *E*.

At this point there is a divergence in routing the blanks; some go to milling machines, where they are mounted in rows, and a gang of cutters mills the grooves and the clearance on the lands. However, the majority are sent to the forge shop after turning the shank and there the flutes are twisted to their spiral form. This twisting is similarly performed on the drill blanks which have been milled as before noted.

The twisting is accoplished by means of the small device shown in Fig. 6. The blanks are heated in an oil

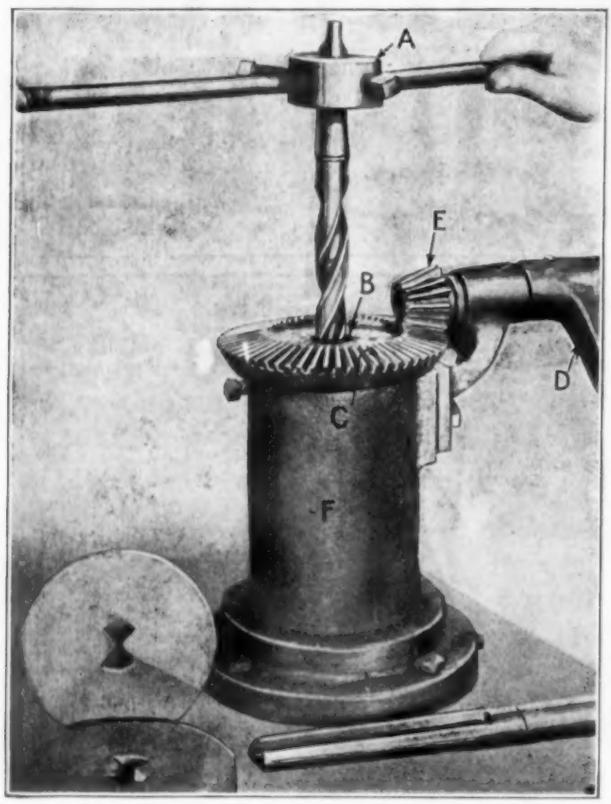


FIG. 6. MACHINE FOR TWISTING DRILL BLANKS

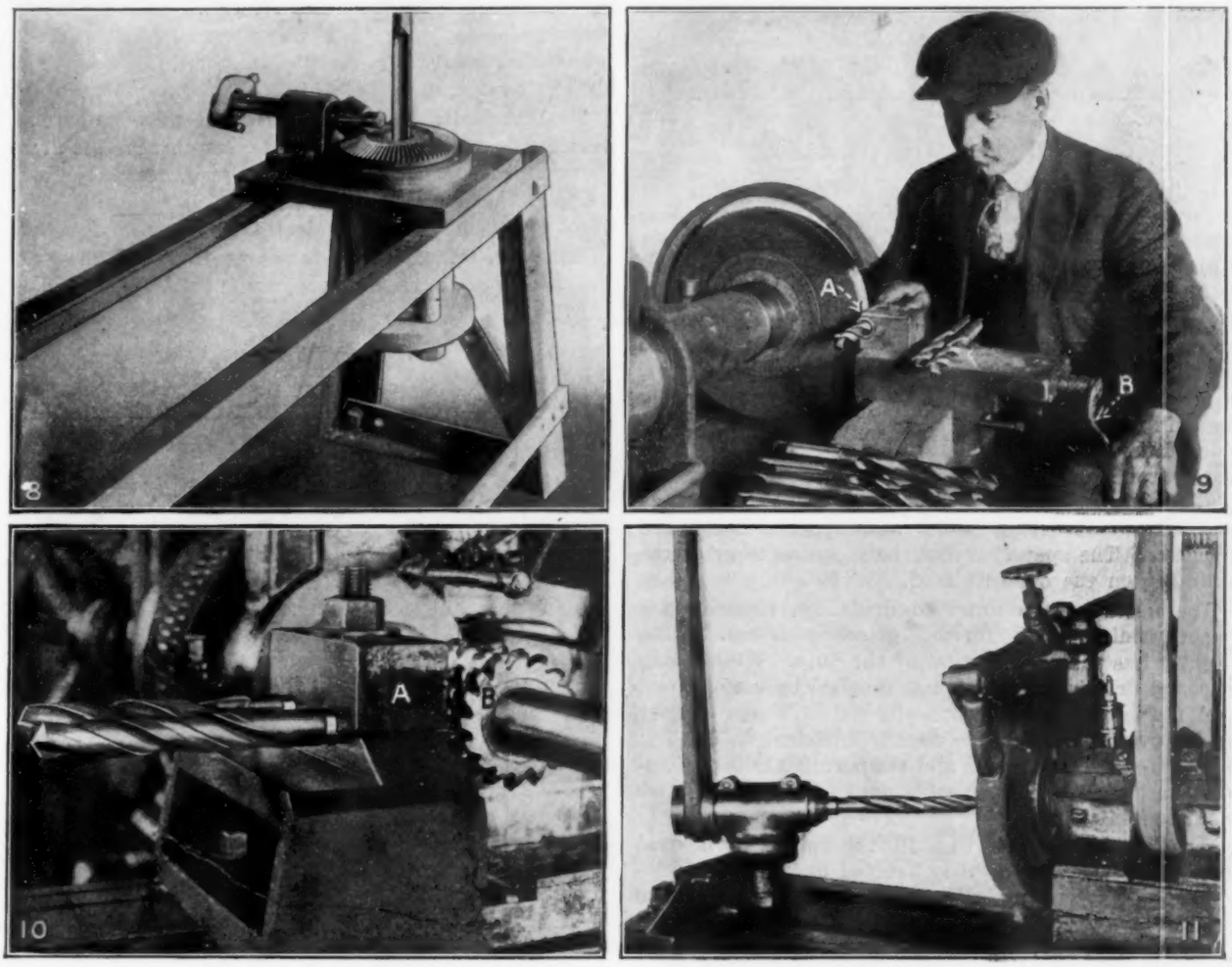
furnace and when withdrawn, a holding lever or dog *A* is clamped to the shank. The fluted portion is then inserted in the hole *B* in the center of the bevel gear *C*; this hole being a loose fit for the drill section, the blank slides through it until the end of the flute stops further descent. The handle *D* at the right of the fixture is revolved, driving the bevel gear *C* through the pinion *E*, and this turning movement, which twists the hot drill blank, is continued until a positive stop is reached.

The stop in the turning movement of the twisting machine insures that the proper and constant angle of twist has been obtained. By reversing the crank motion very slightly in order to relieve the pressure, and by lifting and revolving the drill, it may be withdrawn from the device. After clearing away the drill the crank is revolved in reverse until the opening again stands in the original position for the insertion of another heated drill blank.

The twisting device was designed to give a uniform helix angle regardless of any tendency of one part to twist faster than another because of any difference in local temperature. In order to accomplish this, the barrel *F* of the device is filled throughout its height with plates similar to those shown at A, Fig. 7. These plates have an opening *B* in their center which is a loose fit for the forged section of the drill blank. Near the outer edge of each plate are two slotted holes *C* whose lengths depend upon the thickness of the plate and the angle of twist that it is desired to impart. At 90 deg. from the center of each slot are placed two dowel pins *D*, which project into the slots of the plate above them in the pile.

It will be noted that in the plate *A* the dowel pins are directly in line with the long axis of the drill section and the slots are across the short axis, while in the plate *E* the dowels are across the short axis and the slots in line with the long axis. The barrel *F*, Fig. 6, is filled entirely with these two types of plates which alternate one with the other throughout its height, the top plate having two pins that fit into the under side of the bevel gear. In operation, when the gear is revolved it rotates the plate immediately below it. When the ends of the slots come in contact with the pins of the plate below, that one starts to move in turn. In sequence, all the plates of the series rotate until the drill has been twisted throughout its length. The twist is absolutely uniform because each plate represents, by its thickness, a certain amount of the length of the drill and can only travel through the angular distance allowed by the length of the slots. In actual use the plates move somewhat uniformly as the pressure is applied, until they all reach the limit of their travel.

The character of this machine is such that there is practically no limit to the length of drill blank which



FIGS. 8 TO 11. TWISTING, GRINDING AND WELDING

Fig. 8—A later type of twisting machine. Fig. 9—Grinding the clearance. Fig. 10—Milling the tangs. Fig. 11—Grinding a center on drill ends.

may be twisted, and very long drills may be twisted by inserting them first to their full length up to the shank, and twisting the upper section, and then gradually withdrawing and twisting an additional amount in each successive operation. However, the regular machine which is in use has sufficient length to handle all drills of standard length without resorting to any such method. By the proper design of the plates, any desired angle of helix may be imparted to the drills. In the later types of twisting device, Fig. 8, the main barrel has been eliminated, and the plates are simply held in position by four long columnar bolts which extend from the top to the bottom plate of the device. The illustration also shows the steel frame or bench which is being used for the support of the device and which permits a series of different sizes to be assembled in a row.

Grinding Drills for Clearance

Drills which have been twisted before providing for the relief or clearance are now taken to grinding wheels where the clearance is produced in the manner shown in Fig. 9. The drills are inserted through the close-fitting steel bushing *A* which brings the greater part of the land into contact with the face of the wheel. By turning the handle *B* the device may be fed closer to the wheel as the grinding progresses. A locating screw is provided in the bushing and the operator in drawing the drill forward and back through the sleeve holds the side of the land in contact with it which insures that the clearance will follow the twist. In holding the drill against this locating screw the operator's hand imparts the necessary twisting motion as he pushes it forward and back. The operation must be repeated to grind the clearance on the opposite land.

The flutes of the unmilled drills are ground to a smooth finish on a formed grinding wheel having slightly less radius than that of the flute. While doing this, the drill is supported and steadied by a small rest that fits loosely into the opposite flute. Three or four passes over the wheel are usually sufficient to clean it up. After the hardening and tempering has been completed a finer grade of wheel is used to polish the flutes to a good finish.

A holding fixture *A*, Fig. 10, for two drills is used in milling the tangs as they are fed against the form-mills *B*. The milling cutters are set in pairs to give the proper thickness of tang and the operation is very quickly performed.

Oil-Fired Furnaces in Hardening Department

From the machine shop the drills go to the hardening room where the usual heat-treatments for hardening and tempering high-speed steel are employed. All the furnaces in this department are oil-fired and the temperature is regulated by pyrometer to insure correct and uniform heat.

To give a true center on the drill end for use during the grinding operations, the turned shank is inserted in a collet and the drill run at an angle against the side of a grinding wheel in the manner shown in Fig. 11, thus providing a center on the end that is true with the turned shank. In grinding both the taper shank and the body the drill is supported at the point in a pivot chuck while the shank end runs on a center. From this point, after suitable inspection, the drills are ready to be placed in stock.

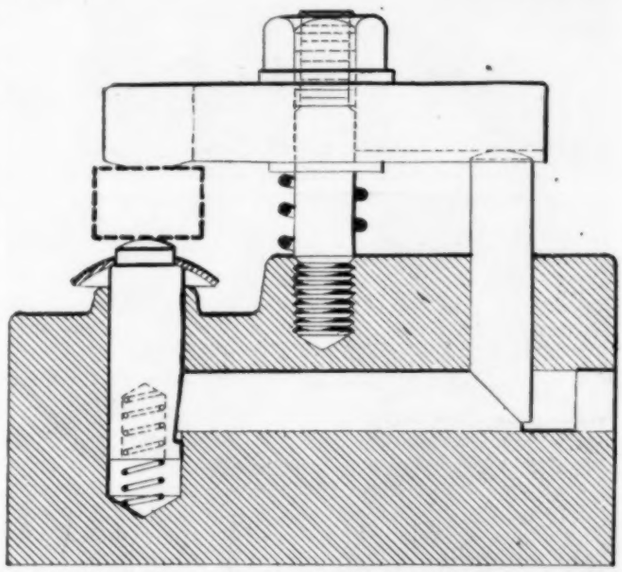
Clamping Device With Automatically Locked Spring Plunger Support

By R. W. Belmont

We had been having considerable trouble with jigs in which the work is partly supported by movable spring-actuated plungers which are set screwed to a fixed position after the work is clamped in place, but before the operations are begun. The trouble is due to the fact that the operator forgets to tighten the spring plunger, and the work is sprung. To overcome this we have designed a clamp which tightens the plunger automatically, thereby taking this responsibility off the operator.

The illustration shows the principle upon which the device operates. Tightening the clamp brings the pressure to bear upon the spring plunger through the medium of the two bevelled end studs.

[We are somewhat skeptical as to the practicability of this device. It looks to us as if the purpose of the spring-actuated support was being frustrated.—Editor.]



CLAMP TO TIGHTEN WORK AND SPRING PLUNGER

To the Men Who Served

One of the neatest and most satisfactory tributes to the men who left the shops to fight in the great war has been issued by the Geometric Tool Co., New Haven, Conn. It consists of a splendidly printed book of eighty-four pages, entitled "To the Men Who Served," and contains portraits of all but three of the thirty-nine men who went from that shop, together with a brief history of the activities of each.

Nearly every branch of the service is represented, some even going into the British and Canadian ranks. Only one made the supreme sacrifice, being killed at the battle of the Marne. Thirty-one have returned to the shop, and a few are still in service. This makes a touching token of appreciation which may be preserved by each and it cannot fail to bind all in a close bond of human sympathy.

The Pattern Shop at Balboa

By R. D. GATEWOOD, COMMANDER U. S. N.

If you had to equip a pattern shop a thousand miles from its nearest neighbor, to handle any kind of a job that came along, what machines would you select and how would you lay out the shop? Here is the way they did it in Panama and also some of the work they turned out.

PATTERN shops are, as a rule, shops contributing only indirectly to production, and therefore treated as secondary in importance and given inconvenient, inefficient and oftentimes an out-of-the-way housing. The pattern shop at the Balboa shops of the Panama Canal, however, has been given quarters as convenient, efficient and up-to-date as its machine shop, boiler shop or any of the other departments. It has been appreciated that pattern work must be done well and expeditiously if the foundry and shop work is to be turned out in the shortest possible time; and, in accord with the general policy pursued by Canal officials, it has been realized that a well-equipped and properly lighted shop is necessary for any body of workmen from whom maximum output is expected.

The building which houses the pattern shop is a two-story concrete building with steel trusses to support the roof, the upper floor constituting the pattern shop and the lower floor being fitted up with a modern, sanitary lunchroom with all conveniences. Adjoining this building and connected with it by a covered runway is the pattern-storage building, a two-story building devoted entirely to the storing of patterns.

A 20-ton traveling crane runs from the foundry to the pattern-storage building so that a pattern, upon completion, may be placed in storage or sent direct to the foundry.

The floor occupied by the pattern shop has no columns to interfere with the work and has been provided with all possible conveniences for the workmen, for the purpose of getting out the work expeditiously as well as for their personal comfort. The office is centrally located, adjoining the runway entrance, while toilet conveniences and a sanitary drinking fountain have been placed

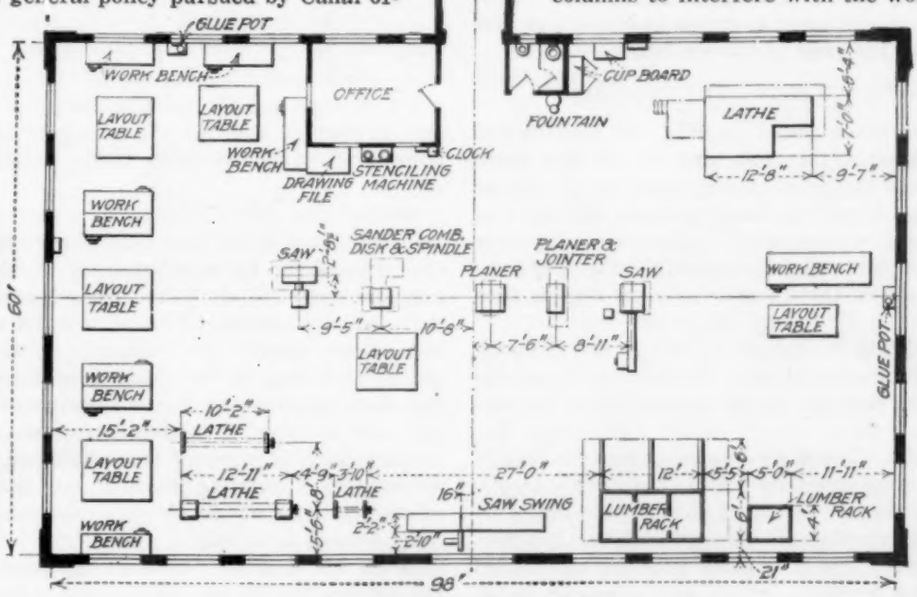
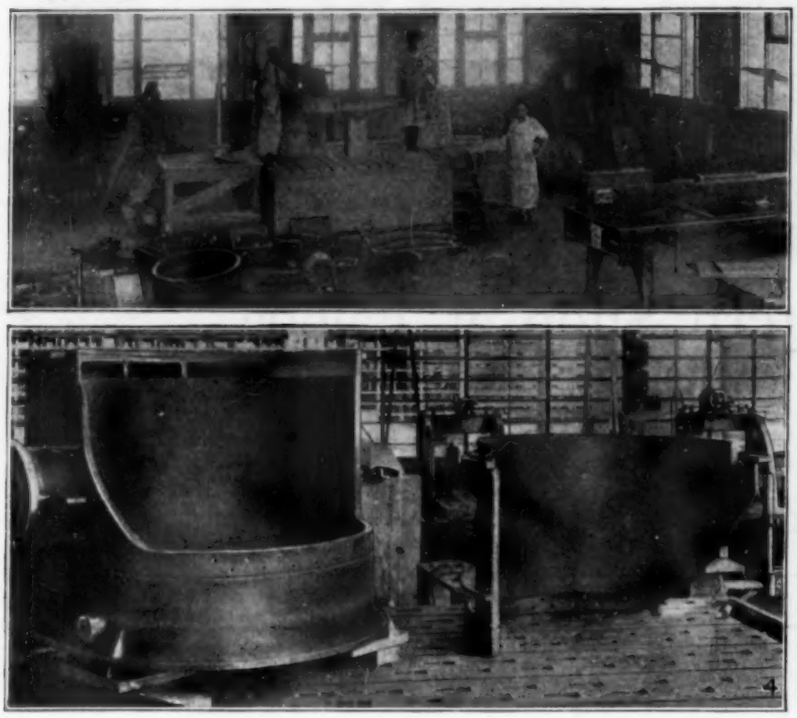


FIG. 2. THE SHOP LAYOUT

along one side. The windows on all sides give an abundance of light throughout the room and adequate electric lighting has been arranged so that work can be carried on at night as well as during the day.

All the machinery is motor driven and the arrangement can be seen in the headpiece and in detail in Fig. 2. The lathes are all so located that the operator faces the light. They are driven from overhead lineshaft, all of them being in one group. There are three of them here, the smallest taking work 12½ in. in diameter by 2 ft. long, and the largest one, 20½ in. in diameter by 7 ft. and 1 in. long. In Fig. 3 can be seen the large lathe which is located in the opposite corner of the room and is individually motor-driven. It is capable of taking work 88 in. in diameter over the bedplate and 158 in. in diameter at the rear of the headstock.



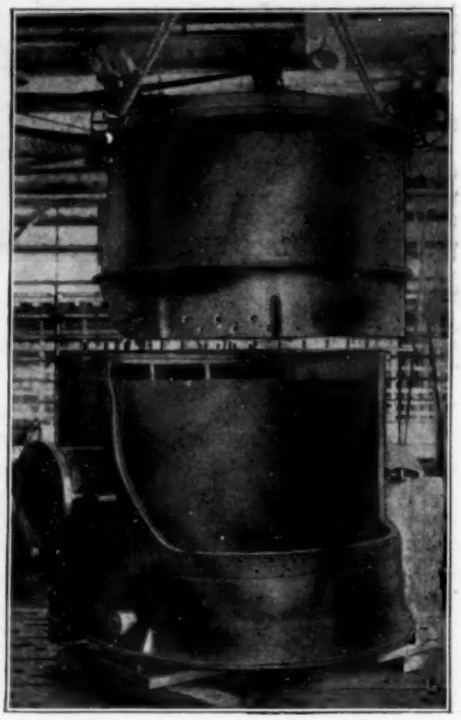


FIG. 3. SOME OF THE JOBS WHICH COME IN. FIG. 4. A DAMAGED GERMAN CYLINDER.
FIG. 5. THE PATCH THAT WAS MADE

The Equipment of the Pattern Shop

The other machines listed in Fig. 2, are located through the center of the room and are on the same group drive, except the bandsaw which has an individual motor. The lumber rack is along one side of the room with swing cut-off saw adjacent. There are also four hand trimmers which will take material from 4 x 4 in. to 9 x 17 in. One of these can be seen in Fig. 1, near the bandsaw.

Several electrically heated glue pots are conveniently placed around the room and along the end wall is an individually motor-driven grinding machine for sharpening edged tools.

This shop also has two stenciling machines for stamping letters and numbers ½ and ¾ in. high respectively. These machines stamp the entire number and name on a zinc strip and provide nail holes in each end for fastening to pattern. This does away with the antiquated methods of using separate letters and numbers which become loosened and drop off, thus dsetroying the record on the casting.

There are 11 journeymen, one apprentice, and a foreman employed here and as the work is of such a varied character, it calls for men with the highest skill. Since the majority of the work done in the entire plant is of the nature of repairs to vessels transiting the canal, it means that very many of the patterns must be made from castings and the broken parts themselves, there being not enough time to allow drawings to be made. In Fig. 3 can be seen a number of pieces sent in to be used as samples for making patterns.

Patterns were made here for the entire engine and parts of the U. S. Coast Guard cutter "Manhattan," completed by the Balboa shops, and turned over to the Navy on Jan. 1, 1919. A few others that have been made are propellers, bitts, chocks, hawse pipes, anchors, gears, pulleys and all work necessary for plant upkeep and extension, and for the complete overhaul of five large ex-German steamers badly vandalized by their crews.

Among the many interesting and ingenious repairs made on these ex-German ships were the repairs to the cylinders of the main engines, all of which, except the high-pressure cylinders, had been dynamited or broken with hydraulic rams. Figs. 4, 5 and 6 will give a good idea of the quality and efficiency of the work turned out by this shop so far away from all ordinary plants and shop facilities. In Fig. 4 is shown the intermediate-pressure cylinder of a 9000-ton cargo carrier with the cracked portion removed and machined away. As will be seen, from noticing the 5-ft. rule laid across the top of the cylinder, it is 48 in. in diameter and slightly more than that in height.

From the cracked portion, the patternmaker takes his pattern for the cast-iron patch shown alongside the

cylinder. After machining, this patch is lowered in place as shown in Fig. 5, and in Fig. 6 it is seen fitted neatly to the cylinder, ready for bolting, boring and final testing. By this method seven large cylinders were saved with about 20 per cent. of the amount of work in pattern, foundry and machine shop required for new cylinders.

All the rolling stock of the Panama Railroad is repaired in the Balboa shops and this also means that patterns for this class of work must be made as well as those for traveling cranes, wrecking cranes and derricks. The miscellaneous floating equipment of the Panama Canal, including the great dredges and heavy machinery of the locks, are also repaired in these shops.

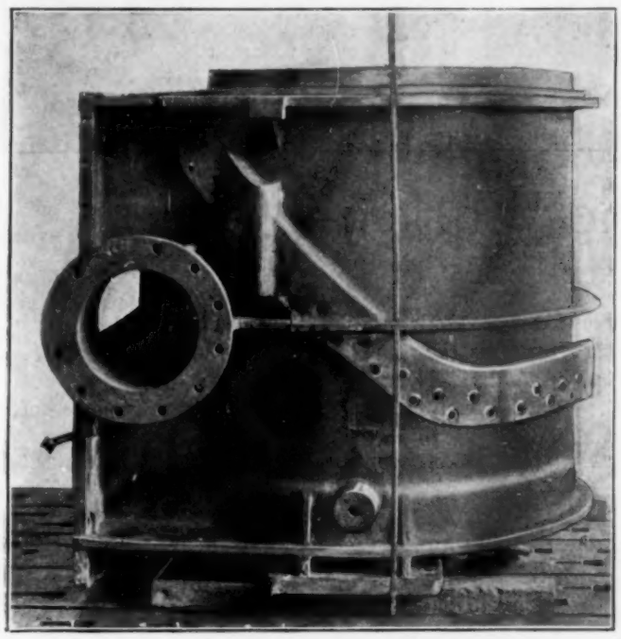


FIG. 6. PUTTING THE PATCH IN PLACE

This shop is really the only well-equipped pattern shop within a radius of a thousand miles. Its working force is extremely competent and experienced and the facilities of the shop as a whole are fully equal to meeting the demands that could be made on it for any pattern of any size or intricacy, that might be required from North or South America for marine, mining, railroad or any other class of equipment.

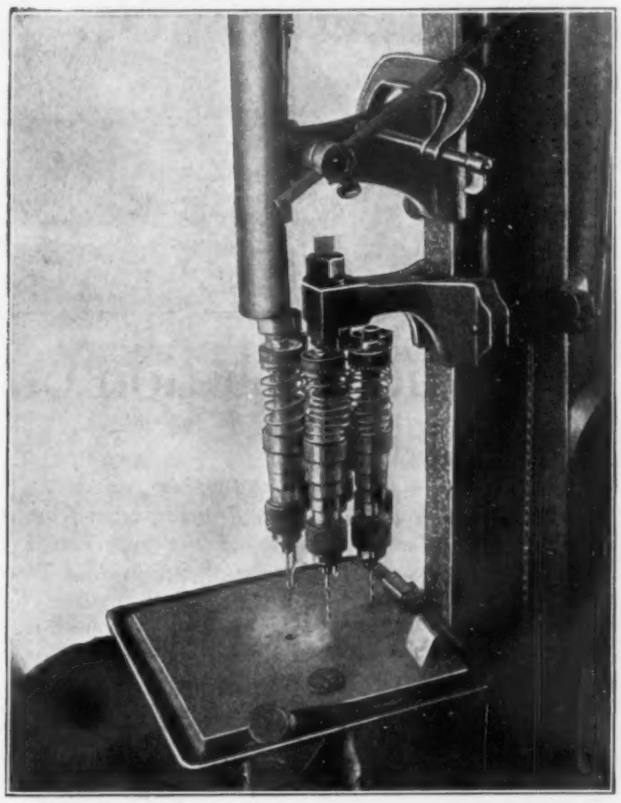
Multiple-Spindle Drilling Device

BY AMOS FERBER

A rather ingenious device for drilling several sizes of holes at one setting of the work is shown in the illustration. Ordinarily, this work would require a six-spindle drilling machine and engage the attention of two or more operatives, but where the output is comparatively limited or the larger machine not available, this device offers a short-cut that is worth the notice of shop men who have work of this character to do.

The spindles are held in a revolving turret which is suspended from a bracket clamped to the column of a single-spindle sensitive drilling machine. The point of suspension in this device is fixed, but the designer called the attention of the writer to the obvious fact that if a slot had been provided at this point the fixture would have been easily adaptable to any small drilling machine.

On the upper end of each spindle is a cone-shaped friction disk faced with fiber, with two oblong holes in its web. An inverted cup-shaped steel driver is attached by a taper shank to the drill spindle, and has on its under surface two sturdy pins which engage the holes in the web of the driven disk. Thus, when the



A SIX-SPINDLE DRILLING DEVICE

spindle of the drilling machine is brought down upon any one of the auxiliary spindles, the latter is first accurately centered by the cup settling over the cone, then started revolving by contact of the fiber surfaces, and finally locked by the driving pins entering the holes of the web. The operator, however, takes no note of this sequence; the spindle is brought down and the drilling done as quickly and as though an ordinary single spindle was being used.

The turret, or "caster," as the designer calls it, is free to be revolved by the operator's hand any time the cup is lifted from a cone. The length of the spindle is adjustable, so that counterboring or other operations requiring a fixed depth may be controlled by a single stop on the main spindle. All spindles are returned to their extreme upward positions by coil springs as soon as the main spindle is raised. The C-clamp shown in the cut is put on as a matter of convenience to keep the main spindle from going too far up when the operator's hand is removed from the lever.

The quill and part of the spindle of the machine is covered by a sheet-metal guard to protect the operator from flying oil and to keep stray curls away.

The designer of this device is Charles Cuno and it is in constant service at the shops of the Cuno Engineering Corp., Meriden, Connecticut.

The Evolution of the Workshop—VII

By H. H. MANCHESTER

In this period the lead in shop methods and devices passes from Italy to France as the result of the progressive policies of Louis XIV and Colbert in this direction. Sweden enters the lists with an iron-slitting machine, only to have the idea promptly stolen by Englishmen. The first micrometer makes its appearance.

(Part VI was published in our March 11 issue.)

BY FAR the most abundant and best evidence in regard to the evolution of the workshop in the first part of the 18th Century comes from France. For this there are various reasons. France was still the leading power of Europe, and Louis XIV, who was yet on the throne, had been a splendid patron of the practical as well as the more æsthetic arts. Colbert had started a systematic policy to make France industrially supreme. He had built up French industries, to take the place of goods which had been imported, by protective tariffs, exhibitions, and prizes for excellence. He had brought in trade secrets and special workmen from abroad, and encouraged new inventions. With the paternal idea of government, he had passed various regulations controlling manufacture, and had organized the corporations, as the guilds in France were then termed, into bodies which were kept in close touch with the government. Colbert was dead but his general policies were for the most part maintained.

On the other hand, Louis had revoked the Edict of Nantes, and in doing so had driven many of the Huguenots abroad. These largely belonged to the manufacturing classes, and their absence soon made itself felt in industry.

A good idea of the new inventions which were occupying the attention of the French savants may be judged from the "Machines Approved" by the French Academy of Science. In 1666 the academy began to publish brief descriptions, and in many cases cuts of the machines of which the descriptions or models had been submitted to them and had passed their inspection.

The very title of the series indicates that the idea of the machine as a device to lighten muscular labor was in the air. In general the designs show considerable ingenuity. The great lack was power, and it will be remembered that Savery had already invented his steam engine.

In 1705 the list of "Machines Approved" included the new micrometer, Fig. 40, by Le Fevre which suggests a growing demand for exactness.

In 1725 Fardouel attempted to invent a machine for cutting both large and small files, Fig. 41. The large ones were cut with a direct stroke of a sharp hammer; while for the small files, the machine worked a chisel and mallet, as was the custom in hand cutting the same tools.

A large lead rolling machine was invented by Fayolle in 1728. The rollers on this were shaped to give the lead various designs. In the same year Fayolle likewise invented a more important machine for drawing lead pipe, Fig. 42, which in its essentials was long in use.

In 1729 we find the Academy occupying itself with the new designs for lathes which were submitted to it by M. Grandjean. They included, according to the titles, one lathe to turn all sorts of contours, another to cut various kinds of rosettes, and a third to produce every variety of screw, Fig. 43.

A more automatic coining machine was invented by M. du Buisson in 1731, and in 1735 a new micrometer by M. Grandjean for use on such fine material as gold and silver.

Nothing further of great interest to our subject appears among "Machines Approved," until 1751 when we find a very important idea presented by Focq for a machine to plane iron.

As an indication of the contrast between France and England in regard to the progress being made in the machine shop in the first part of the 18th Century, it is significant that the British patents on iron and other metals did not disclose a single new metal-working machine between 1700 and 1759, at which date we find a patent allowed to Thomas Blockley for rolling metals with shaped rollers.

Turning from the new inventions as represented in

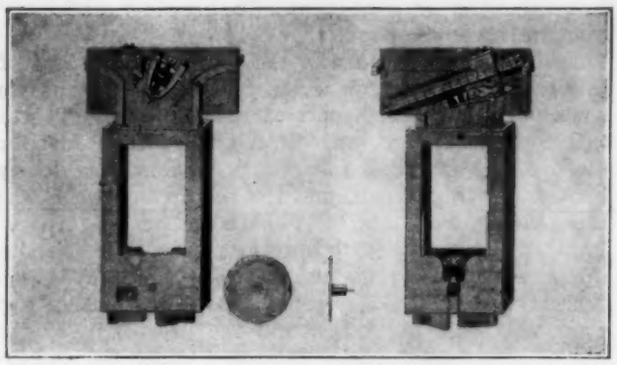


FIG. 40. LE FEVRE'S MICROMETER

the French "Machines Approuvées," and the British patents to machines in actual use in shop practice, we again find the best illustrations from France.

Two of the trades where the need of machinery was felt, in order to lighten the tediousness and quicken the results of hand labor, were the allied ones of nail and pin making.

A treatise on pin and incidentally nail making, published in 1718 and republished in 1761, gives an idea of the machines used in these trades at this period. It includes a cut of 1702 where the work seems to have been done by hand. Hand work, of course, continued to be extensively used as is shown in a view of a pin-making shop of 1718. Fig. 44 illustrates preparing brass wire, dressing it by drawing it between pegs, cutting it into lengths, and pointing on small grindsones turned by large flywheels.

In another cut from the same source, however, we find machines already introduced, Fig. 45. This cut illustrates the turning of the wire into little rings for the heads of the pins, cutting it by hand, and heading the pins by machines. Two such headers are shown, one for a single workman and one for several. The heading was done by small stampers which bit the head into shape. According to a third illustration, much of the polishing was done by shaking the pins together in a bag. It is expressly stated that machines similar to these pictured for heading pins, were also used for heading nails.

A series of illustrations on iron work was published in 1716 and 1717, and the pictures were repeated in a treatise of 1767. One of these engravings, Fig. 46, dated 1716 is very important in illustrating the drilling of iron in a machine shop. The machines employed are small lathes which were run by bows in much the same manner as the old Egyptian bow drill of 5000 or 6000 years before. In 1716, however, the lathes were horizontal and held the tools so as to leave one hand to manage the work while the other ran the bow. In the picture, the lathes are probably being used to drill the holes in scissors, but they were employed for general work of the sort. In the background of the picture may be seen scissors, keys, and other products of the shop, as well as the forge and bellows.

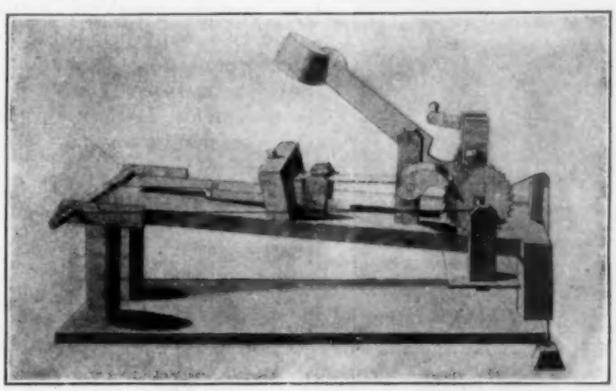


FIG. 41. MACHINE FOR CUTTING TWO SIZES OF FILES

Other engravings of the same series, dated 1717, illustrate the manufacture of ornamental iron and show various processes of forging, punching, and beating, but these are carried on so exclusively by hand as not to demand reproduction of the pictures.

An important engraving, dated 1734, is given in

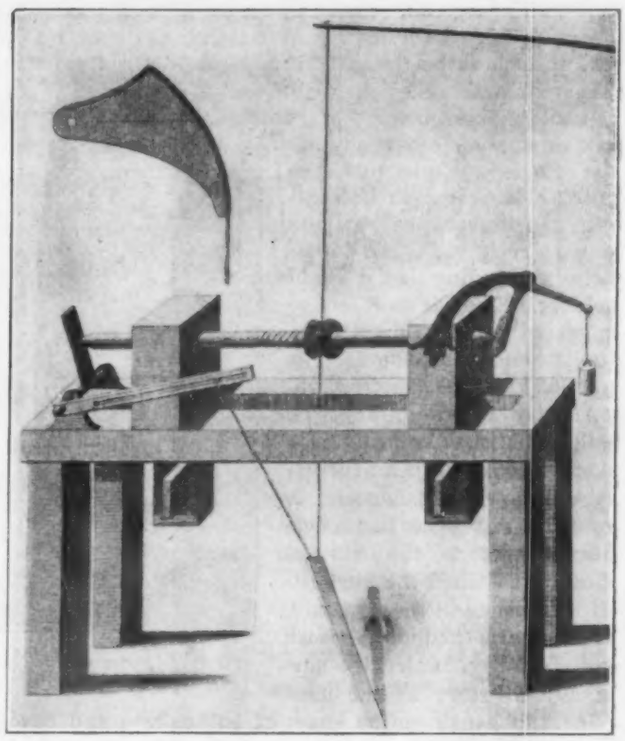


FIG. 43. GRANDJEAN'S SCREW-CUTTING LATHE

Swedenborg's treatise "De Ferre" or "Concerning Iron." It is a splendid representation of a mill, for slitting iron, run by a waterwheel, Fig. 47. The furnace, waterwheel, and construction of the mill are all plainly shown, and it should be noted that the mill had advanced to a point where it could slit several bars at once.

Taking the first illustration of such a mill from Swedish sources is highly appropriate, for it has been currently stated that successful slitting mills were first developed there, and were introduced from there into England.

An interesting legend of their introduction is preserved in the recollections of the great English author, Samuel T. Coleridge. He says that the slitting mills of Sweden were seriously interfering with the iron workers of England. A fiddler by the name of Foley who lived near Stourbridge, England, a center of the iron industry, conceived the idea of going to Sweden and learning the secret of the bar-slitting mill. He disappeared without telling anyone his destination, and

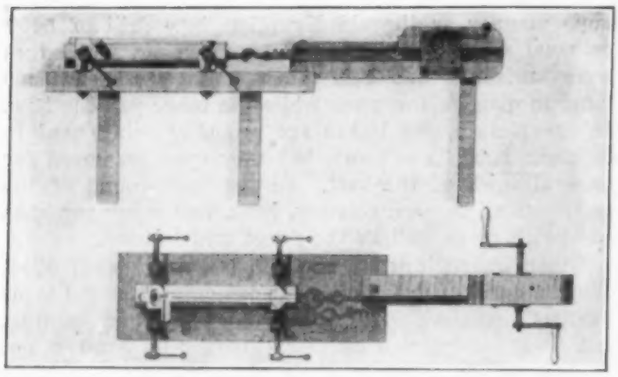


FIG. 42. LEAD-PIPE-DRAWING MACHINE

begged his way to Sweden and the location of the mills. There he fiddled for his living, watched the operations, and as soon as he thought he understood them, quietly decamped and fiddled his way back to England. There he made connections with a man by the name of Knight, who with some others put up the funds to construct the mill. When it was all completed, however, the partners were struck with consternation upon finding that it would not work. Foley, therefore, disappeared again, and returned to Sweden, using his art as a fiddler to get another opportunity of examining the mill. This time he made rude sketches of the machinery before he trusted himself to return. After he had made his way back the various alterations which he suggested were made in the new mill, and it was found to work satisfactorily. Coleridge narrates this story as the most remarkable instance he knew of enthusiasm and devotion to an idea, but it strikes us that the scale of business honor was not as high that as it is now. There is some doubt as to the truth of the legend, but it is certain that the same surreptitious methods were used in bringing a knowledge of silk-throwing machinery from Italy into England.

An important reason why the iron-working shops of England showed as few evidences of progress as we have noted in the first part of the 18th Century, was on account of the growing difficulty of getting fuel for the smelting and other furnaces. These had previously been fed with charcoal, and the scarcity of wood was becoming so great that in 1740 the number of furnaces in action was reduced to only fifty-nine. From about this time, however, the use of coke, which had been experimented with for some years previously, was gradually made a success, and the prosperity of the iron industry was greatly increased under the encouragement of the new fuel.

In William Hutton's "History of Birmingham," there is a notice of the nailers of the district which is important for several reasons. It indicates that in 1741 machinery for nail making was not as yet introduced, and that women were regularly employed in the industry. It likewise pictures a situation in the industry which was part way between the old guild system and the factory system and remained quite common for more than a century.

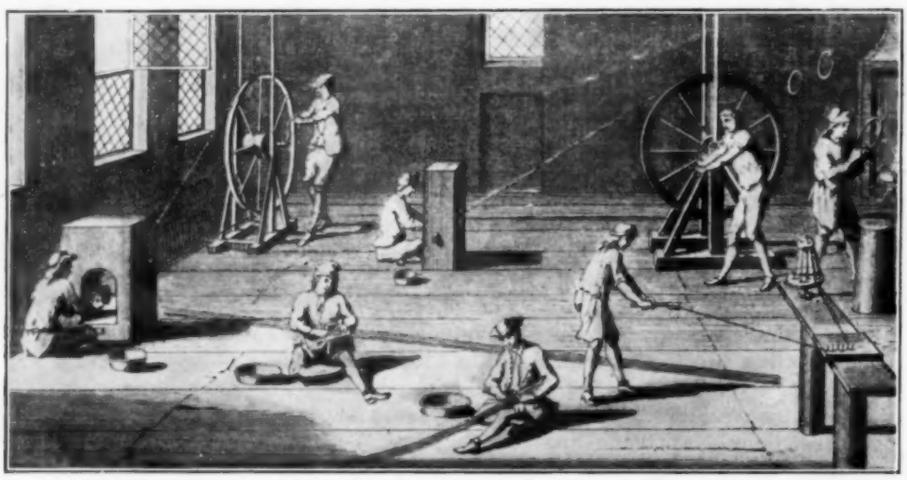


FIG. 44. PIN-MAKING BY HAND

The passage from Hutton is as follows: "When I first approached Birmingham from Walsoll in 1741, I was surprised at the prodigious number of blacksmiths' shops upon the road; and could not conceive how a country, though populous, could support so many people of the same occupation. In some of these shops I observed one or more females stripped of the upper garments, and not overcharged with their lower, wielding their hammer with all the grace of the sex. The beauties of their faces were rather eclipsed by the smut of the anvil; or in poetical phrase, the tincture of the forge had taken possession of those lips which might have been taken by the kiss. Struck

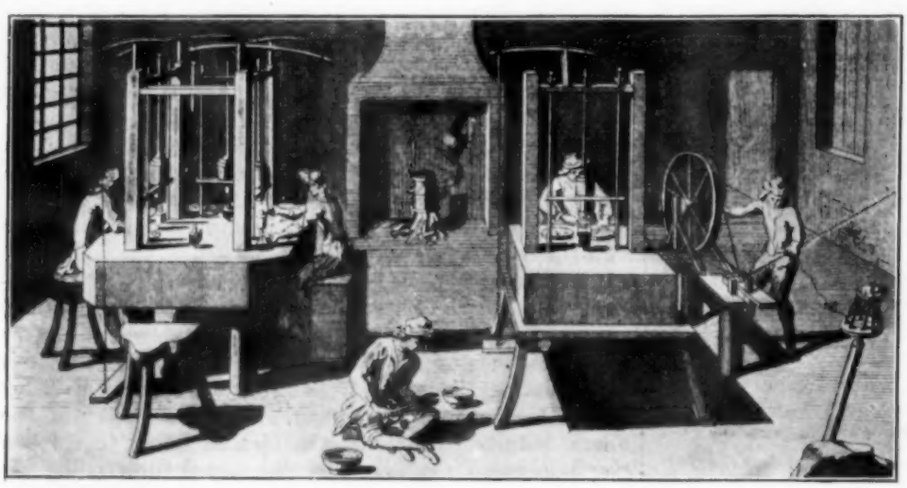


FIG. 45. MACHINES USED IN MAKING PINS

with the novelty, I enquired 'Whether the ladies in this country shod horses?' but was answered with a smile, 'They are nailers'."

It is perfectly evident that Hutton's description indicates neither a guild nor factory system of organization, but a contract system. The guilds, and along with them the old Elizabethan law concerning apprentices, had been falling into decay. In the lines where water power was used, the guilds were replaced by the factory or large shop built around the mill. Where the work was done by small foot machines or by hand, it became quite customary for contractors to purchase the materials and give them out to men or women who did the

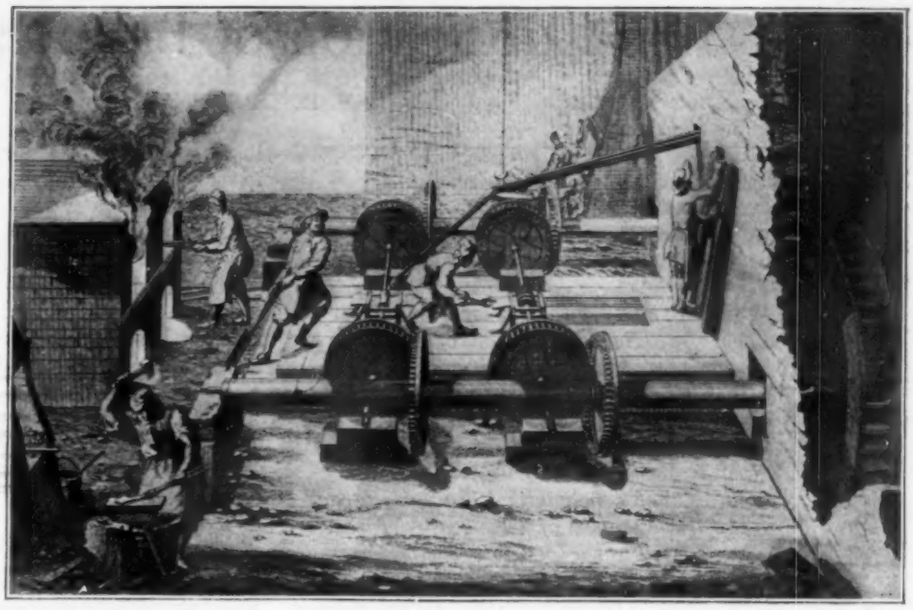


FIG. 47. SWEDISH IRON-SLITTING MACHINE

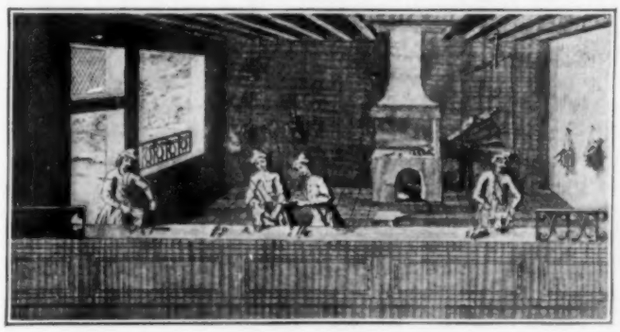


FIG. 46. BOW-LATHES FOR DRILLING IRON

work at home. To this class belonged the thousands of nail makers, many of them women, whom Hutton describes. They probably received their raw material from a contractor, and were expected to return him a stipulated number of nails at so much a piece. In this connection we may remark that the average guild wages per week were then nine or ten shillings ($2.16 to $2.40 per week), at a time when the price of wheat ran from $1 to $1.50 a bushel—a rate at which the guild workman could purchase only about two bushels for his week's work.

Spacers for Step Milling Work

BY GEORGE H. THOMAS

It is one of the well-known principles of accurate machine work and of tool making to make all measurements from the same basic line. The principle is founded on the fact that measurement points will be more exact from a consistent base than with respect to each other both in actual position and the measurement thereof.

Sometimes the principle can be well carried out into production work. Fig. 1 shows the base frame of a calculating machine mounted on a profiling-machine table. Like all machines of this kind, the frame presents on its upper face numerous steps whose differing heights become a complexity of dimensions

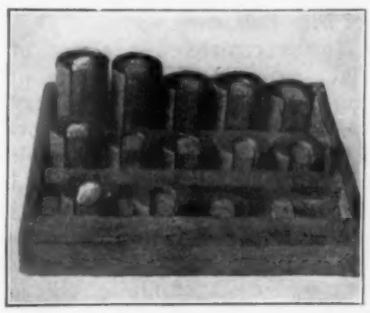


FIG. 2. SET OF SPACING BLOCKS FOR MACHINING DIFFERENT HEIGHTS

with respect to each other, but less confusing with respect to the base face. Naturally, in machining, measurements would be taken from the base line and the extended use of the principle is found in the employment of the series of space blocks shown in Fig. 2. The difference in the length of these blocks corresponds to the steps of the frame to be machined. At *A* in Fig. 1 is a slide member found on most milling machines of the profiling type, and the blocks are positioned in the manner of slip washers so as to effect the varying height of the cutter with respect to the work. The blocks are numbered for their respective employment.

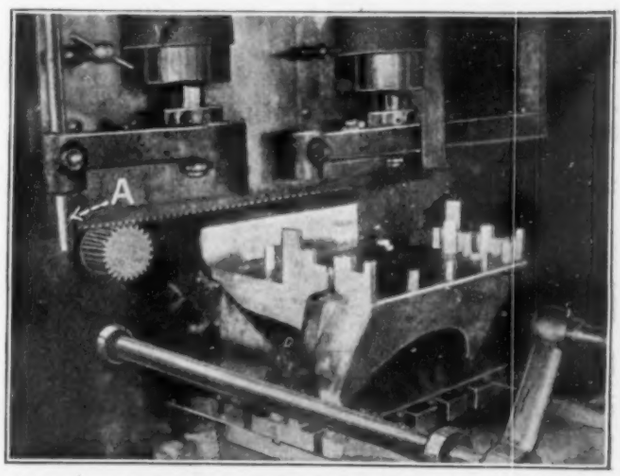


FIG. 1. PROFILING MACHINE WITH CALCULATING-MACHINE FRAME IN PLACE

The Lubrication of Ball Bearings*

By H. R. TROTTER

Ball-bearing lubrication is a subject of which little is known, and this is chiefly due to the fact that there is no accepted method of determining the lubricating value of an oil or grease. As a step toward the development of a satisfactory method the author has devised an instrument for such a purpose, a brief description of which is given in this paper. The operating characteristics of a ball bearing as related to the problem of lubrication are also discussed, and the specifications for a satisfactory oil are given. The use of grease and graphite as a lubricant is next presented and the paper concludes with a suggested procedure for the analysis of lime-soap greases.

AN investigation of existing literature on the subject of ball-bearing lubrication reveals the fact that a comprehensive study of the particular phase of lubrication has not as yet been published.

In 1885 Beauchamp Tower completed a series of experiments to obtain data regarding the behavior of a lubricant under various loads and speeds. The outstanding feature of these experiments was the discovery of the wedge-shaped film of oil. Professor Reynolds later gave the rule for efficient lubrication, which is that where two surfaces are in sliding contact a satisfactory film of oil cannot be maintained unless the surfaces are at slight inclination to each other.

The formation of such a wedge-shaped film of oil can be described as follows: In Fig. 1 is shown a pan or tray *A* containing a small amount of oil. A flat plate *B* is loaded with weights *C*. When in a stationary position the surfaces of the plate and pan are parallel to each other, but if the plate is now pulled along the surface of the pan the leading edge will rise and the plate will flow on an oil film with the surfaces at an inclination to each other. The oil film assumes the shape of a wedge, as shown in Fig. 2.

The Michell thrust bearing, which is manufactured in Great Britain, and the Kingsbury thrust bearing, made in this country, are designed to take advantage of this phenomenon and both have proved very successful. The main features of a bearing of this type are shown diagrammatically in Fig. 3. *A* is the rotating member. *B* is the stationary member. The parts *C* are supported on pivots *D*. A bearing of this type with a diameter of 18 in. will successfully accept a thrust load of 160,000 lb. at a speed of 35 r.p.m. Loads of approximately 10,000 lb. per square inch of bearing surface at a mean surface speed of 54 ft. per second have been carried successfully on short tests on a bearing of this type. At this load the babbitt facing of the blocks flowed in all directions without temperature rise, thus showing that the pressure limit is controlled by the strength of the metal, and not by the breakdown of the oil film.

The final choice of a lubricant is at best the result of a compromise between the engineer and the chemist. This compromise is very often unsatisfactory and due in part to the chemist's inability to thoroughly comprehend the engineer's problem and in part to the engineer's lack of chemical knowledge.

The Testing of Lubricants

At the present time there is, unfortunately, no instrument which will accurately indicate the true lubricating value of an oil or grease. A viscosimeter gives a comparative reading of the inertia of a liquid, but it does not indicate the value of a lubricant under working conditions. It should have sufficient body to withstand the pressures. The lubricant film will therefore consist of three layers, which in operation approximate the features of a ball bearing in that one element is stationary, one rotating and one an intermediate layer consisting of globules similar to the balls in a ball bearing. From this description the importance of body in a lubricant will be realized, and as the best and toughest material is required in the balls of a ball bearing, so is body required in the intermediate layer of a lubricant.

The author has designed an instrument which may possibly be the means of obtaining data of value regarding lubricants. This instrument is shown diagrammatically in Fig. 4. The appliance consists of a revolving element driven by a small motor and a stationary element similar to a block used in a Michell or Kingsbury bearing with suitable means of obbtaining readings of the inclination angle of the block to the revolving element.

Referring again to Fig. 4, *A* marks a casing consisting of an inner chamber which contains the lubricant to be tested and an outer chamber containing oil which is electrically heated and which transmits its heat to the inner chamber. At *B* is shown a small electric motor with a shaft extension on which is placed a flange, the face of which is highly polished. The motor swings on a pivot *C* which allows the flange to take various positions with relation to the block, thus enabling readings to be taken at various rubbing velocities. By means of the lever *D* various pressures may be obtained. The

*From a paper presented at the annual meeting, December, 1919, of the American Society of Mechanical Engineers, New York.

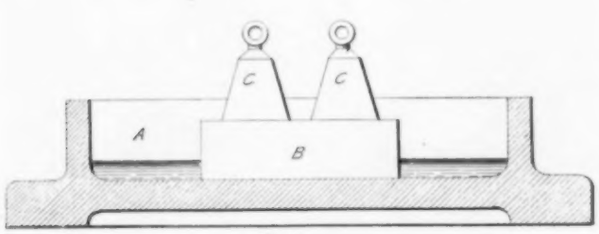


FIG. 1. FORMATION OF OIL FILM (INITIAL STAGE)

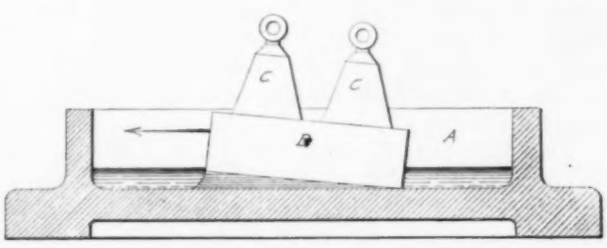


FIG. 2. FORMATION OF OIL FILM (FINAL STAGE)

movement of the block is magnified by minimeters and transmitted to the dial indicator. Holes are drilled in the block and can be connected to a manometer to obtain pressure readings, or as there is practically no pressure difference, the holes can be connected to each other in such a manner that there will be practically no velocity through them. Temperature may be obtained at the leading and trailing edges of the block. Readings may be taken at constant speed with varying loads or with constant load at varying speeds.

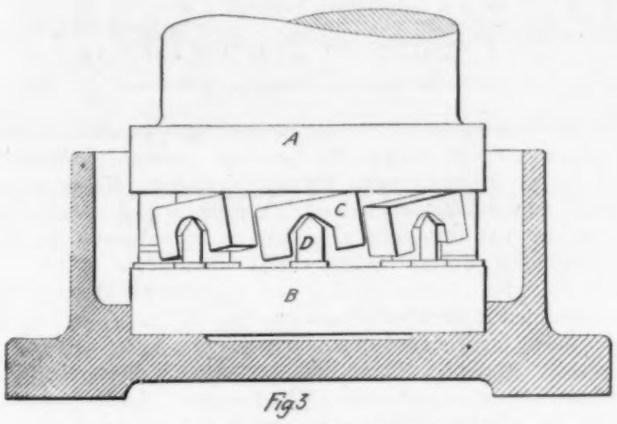


FIG. 3. DIAGRAM OF MICHELL TYPE OF THRUST BEARING

Operating Characteristics of Ball Bearings

With a ball bearing the important points to be remembered are:

(1) The coefficient of friction is practically constant throughout wide ranges of loads and speeds;

(2) Metal-to-metal contact (an oil film only possible at very high speeds when slippage may take place);

(3) The coefficient of friction is lower in an unlubricated ball bearing (at light loads and moderate speeds).

The first point is, of course, generally known, but the conclusion to be derived from this point has not been stated before to the author's knowledge; namely, the impossibility of an oil film between balls and races.

In Fig. 5 curve *A* shows the change of friction coefficient of a plain bearing under constant load and varying speed. This curve is self-explanatory and shows that a satisfactory oil film is not formed till a certain speed is reached. In the same figure curve *B* gives the friction coefficients of a well-made ball bearing, and shows that the friction loss of a ball bearing is practically constant throughout wide ranges of speed. If an oil film were formed between balls and races, curve *B* would possess the same general characteristics as curve *A*.

The difference between the friction coefficient of a lubricated and unlubricated ball bearing is shown in Fig. 6. This property of a ball bearing is not generally known, and should not be used as an argument in favor of operating ball bearings without lubrication. From the foregoing statements it should be evident that plain bearings and ball bearings possess such radically different characteristics that a true comparison is impossible. It naturally follows, therefore, that practically all the accumulated experience of the lubricating engineer is of little value when analyzing ball-bearing operation.

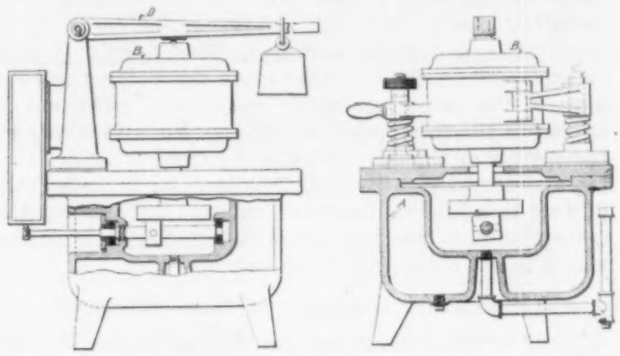


FIG. 4. DIAGRAM OF AUTHOR'S DEVICE FOR OBTAINING LUBRICANT DATA

Requirements of a Ball-Bearing Lubricant

The principal requirement of a ball-bearing lubricant is chemical neutrality. The lubricant used must not contain over 0.10 per cent acid or alkali. There are many commercial lubricants on the market which come within this limit, but very few are acceptable because of their tendency to develop acid with age or when operating at high temperatures.

Most of the high-grade oils can be used with safety, but many of the lubricating greases, while suitable for general purposes, are a positive menace to successful ball-bearing operation. There are now on the market a few greases manufactured especially for ball bearings, but, with one exception, all those tested by the author have proved worthless.

Experience shows that the most satisfactory lubricant for ball bearings is a highly refined mineral oil having the proper viscosity and cold test for the installation. Greases should be used only where operating condi-

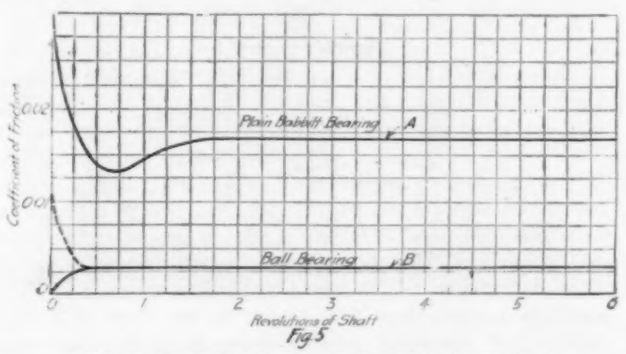


FIG. 5. FRICTION COEFFICIENTS OF PLAIN AND BALL BEARINGS

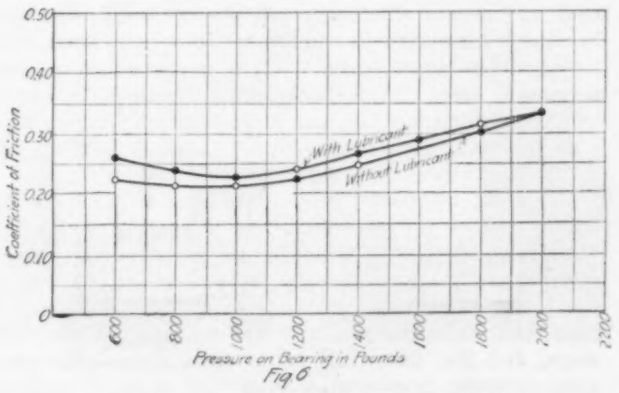


FIG. 6. FRICTION COEFFICIENT OF A BALL BEARING

tions require viscosities greater than can be obtained with a mineral oil.

Whenever a ball bearing is operated at high speeds, it is not advisable to run it submerged in a lubricant, and provision should be made to supply the oil from a pressure system. If such a system is not available, good results may be obtained by a large sight-feed oil cup. A few drops of oil per minute is all that is required.

At moderate speeds a heavy oil will generally give better results than a light oil. The substitution of a heavy oil for a light oil will generally result in a decreased operating temperature. This peculiarity may be explained by the fact that when the bearing is running at the actual operating speed, less opposition is offered to the rotation of the balls by the oil because of the inertia of the oil. In addition, there is less churning and frothing, with their resultant air pockets. Air pockets in a lubricant act as insulators and prevent the transmission of the heat generated to the outer casing where it can readily be dissipated.

Lubricating Greases for Ball Bearings

Many of the greases now on the market are entirely satisfactory for general purposes, but lack certain characteristics which experience shows to be highly important for successful ball-bearing lubrication.

A large number of greases contain lime-soap as thickeners; a few are of the soda-soap type, while others are a combination of both. The lime greases are valuable in that they can be used without harmful results where moisture is present. Their consistency, however, is more easily changed by heat than greases of the soda type.

The following specifications are accordingly suggested: Free acid (calc. as oleic acid), maximum, 0.10 per cent.; free alkali (calc. as sodium hydroxide), maximum, 0.10 per cent.; free lime (calc. as calcium oxide), maximum, 0.5 per cent.; neutral saponifiable oil, maximum, 1.0 per cent.; viscocity of mineral oil (minimum 200 sec., Saybolt universal, 100 deg. F.); abrasive particles (sand, etc.), absent.

The highest-grade ball-bearing greases are put through a milling process after compounding. This treatment insures very intimate mixing of all constituents and pulverizes any chance impurity to an impalpable powder. It is strongly recommended that all greases for ball bearings be so treated.

Graphite, despite its unctuous qualities, cannot be regarded as a true lubricant. It can, however, be used with success in plain bearings as it fills in the interstices in the bearing surfaces and allows the true lubricant to operate efficiently. A modern well-made ball bearing with mirror-like finish has, however, practically no scratches when magnified 100 diameters, and, furthermore, were there irregularities present, graphite would not eliminate them as there is considerable difference between the sliding action of a plain bearing and the rolling action of a ball bearing.

Graphite, moreover, has a tendency to pack in the ball retainers and raceways, and a bearing which has been lubricated with graphite grease generally has a distinct wavy appearance in the ball paths. A recent brief test of a grease containing graphite revealed the fact that while the graphite did not pack in the raceways, and the wavy ball paths were absent, the complete raceway presented a burnished appearance quite different from that obtained by the use of ordinary greases. The graphite packed hard in the ball retainer and could not be removed by dipping in gasoline.

The use of graphite in ball-bearings cannot therefore be regarded as beneficial, and its application is purely a question of economics. Its use in ball-bearing automobile transmissions and rear axles is advisable only if the increased efficiency and life of the gears offset any possible harmful effect on the bearings.

Erasures on Tracing Cloth

By D. C. Howard

In making machine detail tracings general layout plans, etc., it frequently becomes necessary through error or change in idea, to make erasures. These often cover considerable area of the cloth and it sometimes occurs that the same area has to be subjected to the scrubbing process several times. The usual result is a mussy spot on the tracing and a corresponding cloudy area on the finished blueprint.

Many draftsmen and detailers, who make a tracing neatly finished in other respects, either through inability or carelessness stumble over these erasures. In the ideal tracing the eraser should not be used, but this degree of perfection is seldom attainable.

If the following suggestions are adopted, there will be found no difficulty in removing inked lines and lettering from the same area on standard tracing cloth as many as eight or ten times. Obviously the better grades of cloth will stand greater scrubbing.

At the beginning, remove the dirt and grime from the spot to be erased with gasoline and a clean cloth. Use a celluloid erasing shield in preference to one of metal, and a pencil eraser. The popular Ruby rubber is about as good as any. Do not use ink eraser on tracing cloth at any time. Rub very carefully across the lines, at no time allowing the eraser to generate any heat. Cleanse the eraser frequently on emery or sand paper, using care than no grit becomes embedded in the rubber.

When all trace of ink is removed, use a few drops of Three-in-One oil on a flannel cloth to carefully rub the erased area. Wipe off all excess and dust lightly with fuller's earth or talc powder. Replace the polished surface of the tracing cloth by rubbing in finely powdered soapstone.

If care is used throughout the above method, new inked lines and lettering may be placed in the erased area several times and there will be no cloudy spot on the blueprint. However, if the fibres of the cloth are raised in the process, they may be burnished down at the time the oil is applied, with the rounded end of a right line pen handle.

Remember—careful erasing is slow work.

Shops which get a reputation for dropping men as they approach any age limit whether it is 40 or 50, find that valuable men seek other jobs several years before they reach those limits. Actual years have little relation to working capacity. Overanxiety, anger, worry, and most of all fear, all contribute more to age a man than even physical dissipation. More people suffer from fits of anger than from drink, more from fear than from late hours. Men who live in the fear that at some definite period they will begin to go down hill, and instead of choosing jobs will be lucky to have one, cannot do good work.—*Brass World.*

US ARMY ORDNANCE NEWS

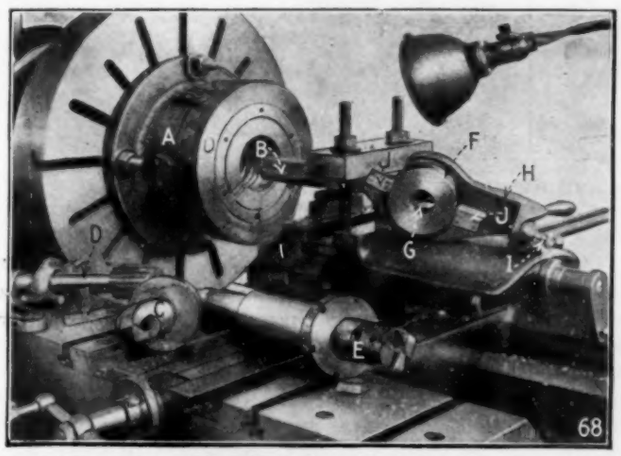
Machining Problems Solved In Gun Making—V

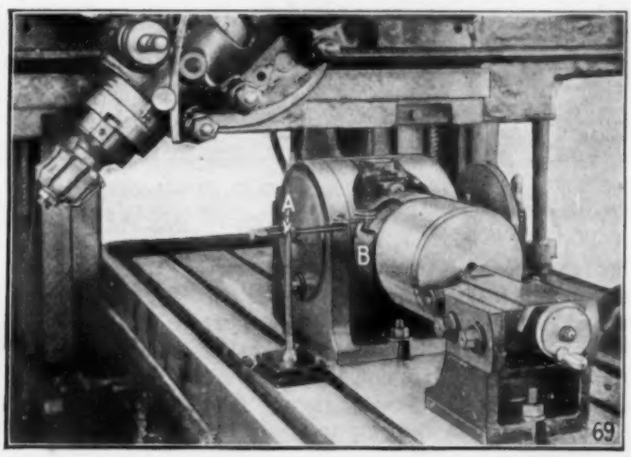
By J. V. HUNTER
Western Editor *American Machinist*

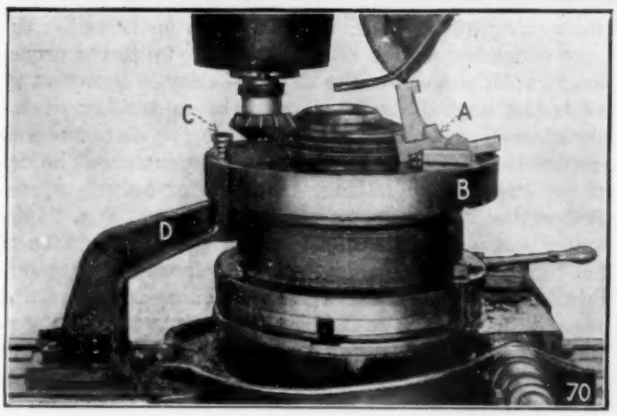
Previous installments have shown how the major parts of the 4.7-in. gun were machined. This last article of the series tells how the same careful methods and accurate tools and fixtures have been applied to finishing some of the remaining parts of the breech mechanism.

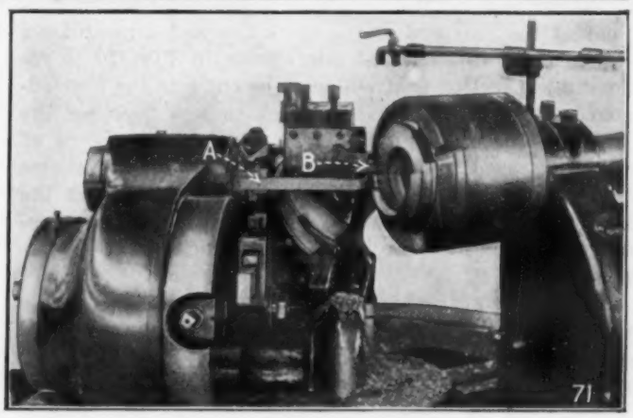
(Part IV appeared in our March 18 issue.)

THE set-up of the breech block shown in Fig. 68 is used for several operations. The block is held in the large pot-chuck *A*, and the illustration shows the cutting of the internal threads using the threading tool *B*. Other tools which are used in connection with this work are the three-lip end mill *C*, the reaming bar *D* and the wood-packed reamer *E*. The latter is similar to the wood-packed reamers used for gun-boring operations. A special tool-guide bushing *F*, which is used during the bore cuts in the small interior pocket, has the large bushing *G*. The latter fits in the large open end of the block, and this has an extension arm *H* with a pin *I* which fits over the chuck and locks it into position. The hardened-steel guides *J* then serve for marking the quarter lines for determin-





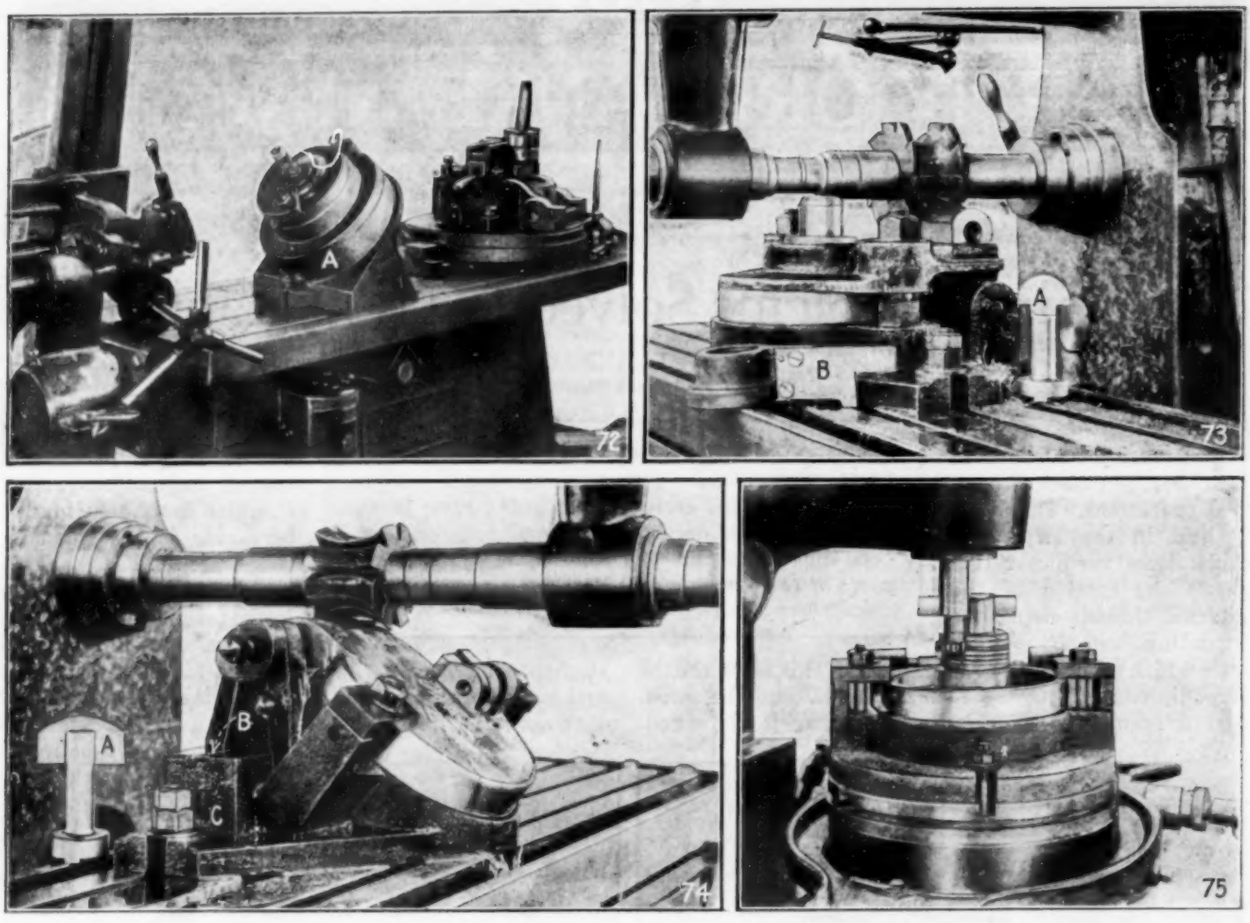




FIGS. 68 TO 71. SOME OPERATIONS ON THE BREECH MECHANISM

Fig. 68—Finishing the interior of the breech block. Fig. 69—Set-up for milling the sectors on the block. Fig. 70—Relieving the section for the bevel gear. Fig. 71—Cutting the bevel-gear sector.

ARMY ORDNANCE NEWS



FIGS. 72 TO 75. DRILLING, MILLING AND REMOVING FEATHER ENDS

Fig. 72—Drilling vent holes through the block. Fig. 73—Milling the radius on the hinge section of the carrier. Fig. 74—Milling the back radius on the carrier. Fig. 75—Removing the feather end of the square threads.

ing the position for the start of the thread The set-up which is shown in Fig. 69 is used for milling out the sectors in the threaded outside surface of the breech block. As here shown, the job is being set up ready for the start of the first cut, and the surface gage and indicator *A* are in service gaging from a point on the plate *B* of the holding fixture, which is also used for a guide for setting the cutter in position. Certain portions of the rear end of the block are milled away by a series of operations; the one shown in Fig. 70 is relieving the section that will later be cut into the beveled-gear sector which turns the block to lock together the interrupted thread of the block and breech. Some of the gages used in connection with this work are shown at *A*. The piece during this operation is held in the body chuck *B*, which can be indexed around to any required position by the pin *C* which locks into the extension arm *D*.

A Gleason gear shaping machine is used to generate the teeth in the bevel-gear section previously mentioned and the work is shown being set up, Fig. 71, using gages *A* and *B*, which are provided for this purpose. The drilling of several vent holes through the block is done on a Barnes horizontal drilling machine with the block held at the proper angle by the indexing fixture *A*, Fig. 72.

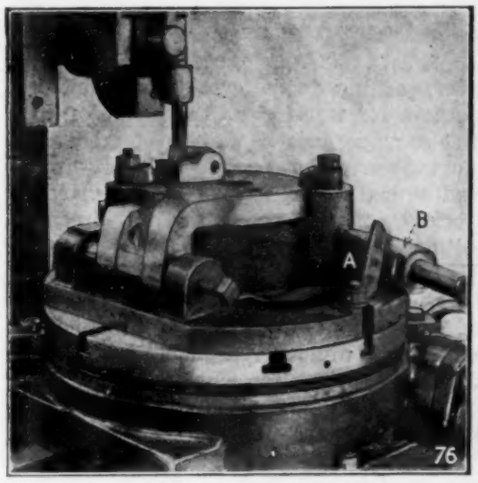
The early operations on the inside of the breech block carrier forging are performed on Gisholt turret lathes which finish the back and turn the interior and center lug.

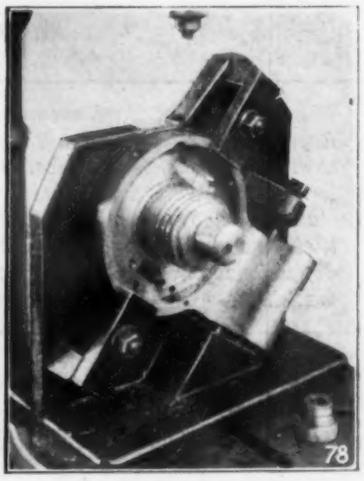
Milling-Machine Operations

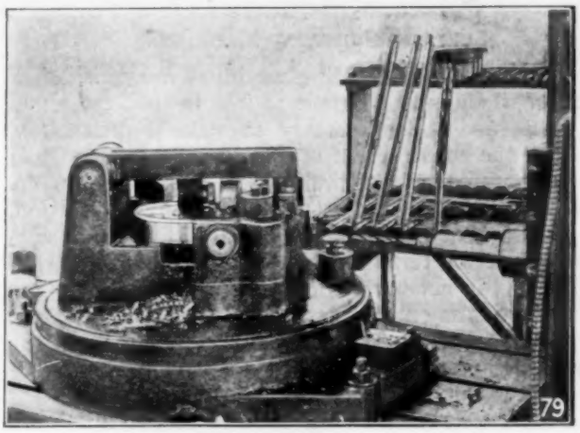
Following this are a number of milling machine operations on the hinge lug; that shown in Fig. 73 is the milling of the 1-in. radius on the outer end. The gage which is used for setting the table up to the proper height with respect to the milling cutter is shown at *A*, while the gage *B* is fitted over the center lug of the block carrier when setting the table for distance with respect to the longitudinal axis of the cutter. The use of the gage *A* for setting the table for height is handled in the same way as another gage *A*, Fig. 74, in connection with the milling cut on the rear surface of the hinge lug, as handled on a Cincinnati milling machine. It will be noted that this milling-cutter setting gage *A*, has a key in its base which fits into the keyway *B* cut on a side shoulder *C* of the milling fixture. When this gage has been pressed down to a full bearing on this shoulder, the cutter may be set by it, to exactly the right height for finishing this portion of the block carrier.

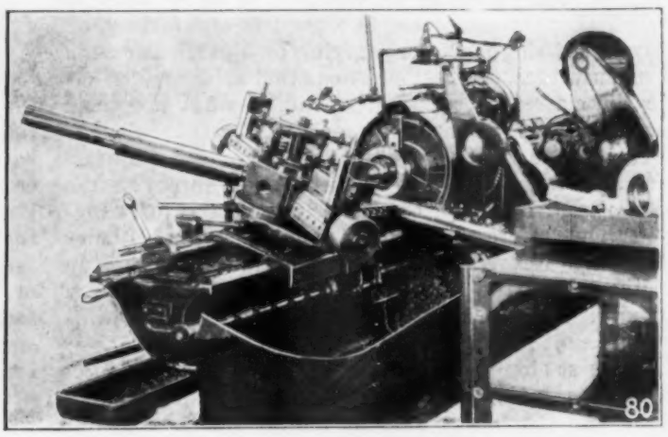
A milling operation used for the removal of the end

ARMY ORDNANCE NEWS









FIGS. 76 TO 80. OPERATIONS AND JIGS USED ON THE BREECH MECHANISM

Fig. 76—Slotting holes through the carrier. Fig. 77—The box jig for drilling operations on the carrier. Fig. 78—Drilling operations on the carrier. Fig. 79—The revolving and indexing jig. Fig. 80—Turret-lathe operations on loading tray forgings.

or narrow points of the thread on the inside lug is shown, Fig. 75, on the table of a Milwaukee milling machine. The slotting of the irregular shaped holes in the face of the block carrier to receive the operating lever and other parts is accomplished on a Pratt & Whitney vertical shaping machine, Fig. 76. The fixture used for holding the parts during this operation and some of the gages *A* and *B* used in connection with this work are also shown.

Two drilling operations showing the types of jigs used illustrate the methods by which this work is handled, Figs. 77 and 78. A third drilling jig and fixture, Fig. 79, is mounted on the bed of a Barnes horizontal radial drilling machine so that it may be indexed around and lined up with the spindle for the drilling of the several holes required in the edges of the block carrier and through the operating lever lug.

The loading tray is furnished as a peculiar-shaped steel casting, and requires a number of interesting operations for its completion. One of these is the Gisholt turret-lathe operation, Fig. 80, which finishes the major portion of the outside of this casting, turns the flange and completely bores it. The loading tray actually occupies only about one-third of the circumference of the breech section of the gun, and by this manufacturing method it is first machined in the form of a complete circle, and later sawed into three segments which are finished to produce three loading trays.

Hardening Duralumin

Duralumin, an alloy of aluminum, can be hardened by quenching at temperatures below its melting point and allowing it to stand at ordinary temperatures. The hardness is not produced by quenching alone, but increases during the period of aging, which may be from one to three days. The composition of duralumin usually varies within the following limits:

	Per cent
Copper	3 —4.5
Magnesium	0.4—1.6
Manganese	0 —0.7
Aluminum	Balance
Iron (as impurities)	0.4—1
Silicon (as impurities)	0.3—0.6

Its density is about 2.8. It is used only in the forged or rolled condition.

This alloy has been produced for some years commercially and is in demand for the fabrication of parts for which both lightness and strength are required, such as for aircraft. Its tensile strength will average 50,000 to 60,000 lb. per square inch after appropriate heat treatment.

The Standardization of Grinding Machine Classification

By CAPTAIN S. M. HENRY

The engineers of the Bureau of Construction and Repair in our Navy Department have done much to standardize shop practice. It is their endeavor to have this work constructive, to utilize accepted standards as far as possible. This example shows their endeavor to get logical and understandable definitions for the different kinds of grinding machines.

THE absence of a generally recognized system of nomenclature for grinding machines proves embarrassing in endeavoring to investigate the equipment that should be supplied for an industrial plant doing work requiring this important class of machine tool. Whether an endeavor is being made to see whether the equipment in a plant is satisfactory, or a layout is being made for carrying on a particular class of manufacture, the first questions that arise are, "What are the classes of grinding machines, what are their uses, and what are their differences?"

There seems to be little uniformity among manufacturers of these machines or the manufacturers of the wheels used by them, or among the writers of handbooks and reference books. In one case a particular machine is referred to as a grinding machine, while in another place the same machine is referred to as a grinder. In one book a grinder is a plain grinder while in another it is a cylinder grinder, and so on.

The first step in the consideration of a plant's equipment of grinding machines should be to divide all of them into their main classes, and if the investigator feels so disposed, his next effort may be to attempt to devise some logical system of nomenclature by which the same machine may always be referred to in the same way, or if he calls a machine by a certain name one day that he will be able to recognize the next day what it was that he had in mind.

The Natural Subdivisions

The first natural basis for a subdivision that would suggest itself is the class of work that is to be performed, and perhaps second, the type of construction of the machine, and finally, the type of wheel used, taken in conjunction with the use or non-use of water or other lubricant.

A suggested division of the more usua. classes of grinding machines (and it is proposed to refer to them all as grinding machines rather than grinders) is as follows:

Cylindrical grinding machines.
Surface grinding machines.
Hand grinding machines.
Portable grinding machines.
Tool grinding machines.

If this proves to be a reasonably logical division there must be a further subdivision, so that each of the various types of machines can be referred to with an assurance that some one else, seeing the reference, can form a reasonable mental picture of the machine referred to. Taking the first classes, it is clear that there are grinding machines for working on the outside of cylindrical surfaces, and others for working on the inside of such surfaces. These may perhaps be fairly referred to as "outside cylindrical grinding machines" and "inside cylindrical grinding machines." The universal grinding machine also belongs in this class, and, as it can be employed in either class of work, it may perhaps be consistent to call it a "universal cylindrical grinding machine."

The class of grinding machines used for cylindrical work, therefore, can be divided reasonably logically on the basis of the class of work for which they are used, without any serious departure from common nomenclature, though what we are now calling an "outside cylindrical grinding machine" is much more frequently referred to as a "plain grinder" or "plain grinding machine."

Surface Grinding Machines

When the surface grinding machines are considered, the rules which seem to apply so well in the first group fall down, and it is necessary to make a distinction, based on the construction of the machine rather than on the character of the work it is called upon to do. Even the name itself is not a very fortunate selection, for all grinding machines are used for grinding surfaces, but if the term "surface" is replaced by "plane" or "flat," it is not more correct because irregular surfaces are ground on this class of machine as well as flat surfaces. Assuming that it is necessary to adopt the construction of the machine as a basis of reference, the principal machines of this type can be divided into the following four classes:

Open-side surface grinding machines.
Planer-type surface grinding machines.
Vertical-spindle surface grinding machines.
Side surface grinding machines.

In many shops the only type of grinding machine used is what is commonly called a "double grinder," used for snagging work, for miscellaneous grinding such as the removal of burrs, sharp edges, etc., and this particular machine appears to be the one most difficult to properly label; as there is nothing in the type of work, the construction of the machine, or the form of the wheel, that is reasonably descriptive. For want of a better name, it may be called a "hand grinding machine," as the work is usually held against the wheel by hand. This type, in turn, can be divided into the "bench" and "pedestal" types, depending on the design of the machine, whether based on installation on the floor or on a bench. The next class of machine in this group is the "disk grinding machine," which has the disk or wheel so arranged as to grind with the side rather than with the edge of the wheel. Its general characteristics, other than in this particular feature, are in agreement with the hand grinding machine.

Buffing and polishing is essentially a grinding operation where the coarser wheels are replaced by a much finer cutting surface, but, in a general classification, can be included in this group, the machines being essentially the same as the hand grinding machines, except as to the type of wheel used and the speed of revolution.

The next group includes the portable grinding machines, which may be classified according to their method of drive, the usual method of classifying hand or portable tools, and may, therefore, be divided into:

Pneumatic portable grinding machines.
Electric portable grinding machines.
Flexible-shaft portable grinding machines.

The greatest variety of grinding machines will naturally be found in the group devoted to tool work, and the most reasonable classification for this group would appear to be based on the class or character of tool for which the machine is supplied. This group would include:

Band-saw grinding machines.
Circular-saw grinding machines.
Cutter and reamer grinding machines.
Drill grinding machines.
Drytool grinding machines.
Knife grinding machines.
Universal tool grinding machines.
Wet tool grinding machines.

The outline of the difficulties connected with the classification of grinding machines suggests the desirability of the manufacturers adopting some uniformity in referring to the various machine tools of this class, and the table given below, based on the brief description of the uses and characteristics of the different machines, may serve as a basis for further discussion that will lead to a greater uniformity than at present seems to exist.

CYLINDRICAL GRINDING MACHINES

Inside cylindrical grinding machine.
Outside cylindrical grinding machine.
Universal cylindrical grinding machine.

SURFACE GRINDING MACHINES

Open side surface grinding machine.
Planer type surface grinding machine.
Side surface grinding machine.
Vertical spindle surface grinding machine.

HAND GRINDING MACHINES

Buffing and polishing machine.
Disc grinding machine.
Hand bench grinding machine.
Hand pedestal grinding machine.

PORTABLE GRINDING MACHINES

Electric portable grinding machine.
Flexible shaft portable grinding machine.
Pneumatic portable grinding machine.

TOOL GRINDING MACHINES

Band saw grinding machine.
Circular saw grinding machine.
Cutter and reamer grinding machine.
Drill grinding machine.
Drytool grinding machine.
Knife grinding machine.
Universal tool grinding machine.
Wet tool grinding machine.

Secrecy in Wage Scales

BY FRED B. COREY

On page 438 of the *American Machinist*, the question is asked, "Is the principle of secrecy in granting increases of wages ethical and expedient?"

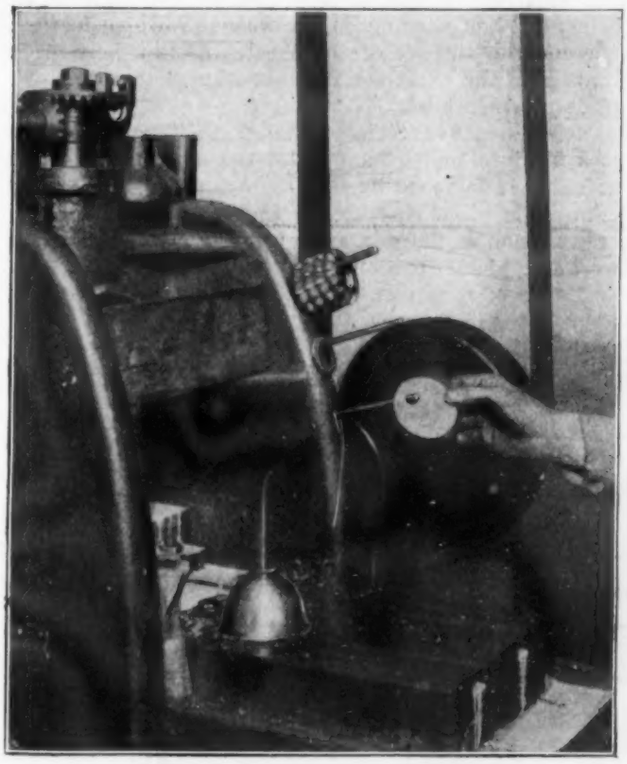
While various organizations and professional bodies have formulated codes of ethics that are generally recognized among their members, the writer knows of no such code that is considered as applying with special force to the conduct of manufacturing corporations in dealing with their employees. However, the principles of ordinary business ethics are pretty well understood —although it is quite true that such ethical principles have been subject to great changes, coincident with important steps in the upward progress of the human race. All men whose memory runs back twenty-five years or more will recall transactions which were considered to be "good business" and unquestionably ethical at the time, yet which would now be called "sharp practice," if not even criminal. We fail to see that any ethical objection could be raised against a secret wage agreement between employer and employee, as it is usually a matter which concerns only the contracting parties. The only ethical point involved in this matter seems to be that wage rates should be, as nearly as possible, fair and equitable to all.

The question of expediency is quite another matter. To be expedient, a thing must be both desirable and practicable. Among salaried employees, secrecy in regard to the amount received is the general rule. This, undoubtedly, is desirable as to its effect on both the relations of the employee to the employer and the relations of the employees to each other. It is wholly reasonable to expect that secrecy in regard to wages and wage increases among the working force generally would have the same desirable result. But, who ever heard of a shop in which such secrecy prevailed? Who believes that such a shop ever will exist? "There ain't no such animal" and, in this case, there never will be.

Pins Set into Machine Frame to Hold Tools

BY PETER F. O'SHEA

A foreman in the Greenfield Tap and Die Corp. uses pins, set into the frames of the milling machines in his department to hold tools. He selects a point where the curve of the housing brings it to an angle of about 45 degrees, and then sets in three pins as shown.



A Gasket Cutter

By S. E. Frew

The sketch shows a device for making gaskets, washers, etc., from thin sheet metal, fiber, or cardboard, and for cutting round holes in these materials.

A cast-iron plate *A* is faced true on the top surface. A central bolt *B* passes through a $\frac{3}{8}$-in. hole in the plate and is held in place by a wingnut on the under side. A steel sleeve *C* is a running fit on the bolt, and *D* is a thin brass washer to take the wear and to make vertical adjustments for the bar *E*. *F* is a sheet of metal or other material to be cut into gaskets, etc.

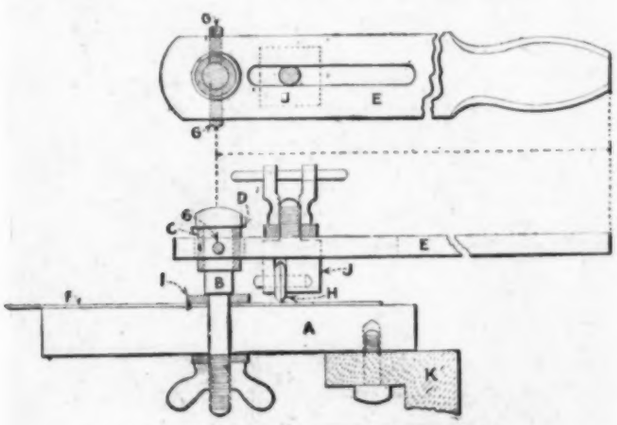
A flat steel bar *E*, $\frac{3}{8}$ x $1\frac{1}{2}$ in., is hinged by two pins *G;* these pins pass through the bar and into the steel sleeve *C*—but do not pass into the bolt *B*.

These pins also provide for a vertical movement of the cutting wheel *H;* the handle being held down by strong pressure as the bar *E* is rotated in a circle, the pressure causing the wheel to cut circular grooves.

The sheet metal being cut is kept from moving by being held down or clamped to the plate by the shoulder of the central bolt bearing on the washer *I* which in turn bears on the surface of the sheet. A $\frac{3}{8}$-in. hole must be made in the sheet for the bolt to pass through.

The movable block *J* carrying the cutting wheel has an adjustment of 3 in. radially. A tongue on the block fits into the slot and holds the block firmly when the latter is fastened by the thumbnut.

An angle piece K, fastened to the plate by suitable screws, enables the device to be held in a vise, or, if two angle pieces, one on each side, be used the device can be placed on a bench or floor for cutting holes.



A DEVICE FOR CUTTING GASKETS

Boring Cored Holes

By H. W. Johnson

During several years' experience in boring cored holes, both in grey and malleable iron castings for harvester parts, I have given the matter of speeds and feeds considerable study. I have tried to follow the recommendations of the drillmakers who advise fast speeds and light feeds, which does fairly well in solid metal, but which, for cored-hole boring, does not seem to give good results.

Because of close competition in the harvester business, which is our line, it is necessary that cored holes be sized in one cut, without any reaming operation to follow. Tolerances as small as 0.003 or 0.004 in. are regularly held with one cut. Fast speeds and light feeds produced more sizes of holes and varieties of finish from one size of drill than even the most tolerant inspector could find use for. Reduction of speed made for better holes, but raised piece rates. Then came heavier feeds. The drills sized well, and produced a lot of holes per day. Then I started to study the problem from the standpoint of inches of feed per minute and inches of feed per grind. The heavy feeds proved best both ways.

IMPROVISED CORE DRILL

I have used a three-lip, high-speed drill on cast iron, boring a $1\frac{1}{4}$-in. hole with a tolerance of 0.004 in. from a cored hole $1\frac{3}{8}$ in. in diameter at a speed of 40 ft. per minute and a feed of 0.068 in. per revolution. This drill would run one hour on a grind. The same drill, however, would fail in a few minutes at 65 ft. per minute, even with a feed as fine as 0.032 in. per revolution.

I have used proportionately heavy feeds on smaller drills and in malleable iron with similar results—and that is not all. These drills, under heavy feed, sized closely to the plug gage, whereas the high-speed and low-feed method produced a miscellaneous collection of tapered holes mostly oversize. I have talked this matter over with harvester men, who agree with me, and with drill demonstrators, who do not.

The worst trouble I have had is with the tangs. The stub tang is the only thing which will stand the gaff in this kind of cutting.

I would like to hear an expression of opinion from men who have similar work to do, as I believe that this condition extends to lines other than ours.

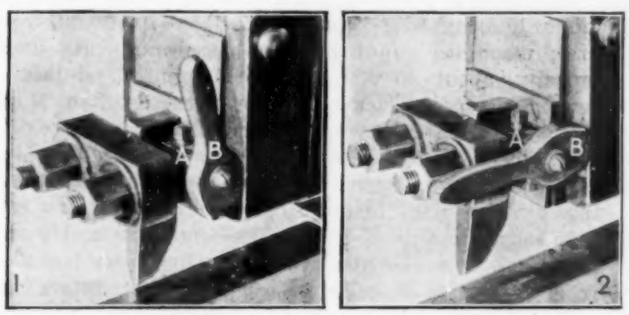
Another troublesome side of this cored-hole boring is the difficulty in boring out small cored holes in malleable castings, using the ordinary three-lip core drill which is so shallow in the flute and so thick in the center as to give poor chip clearance. Worse still, a cored hole slightly out of place would cause the solid center of the drill to run against solid metal. This is soon followed by a wreck.

I took a regular two-lip drill, too large for the job, ground it down to the correct size, and backed it off, leaving two bearing points instead of one on each land, as shown by the sketch. The extra bearing points stopped the tendency displayed by a common twist drill, to wabble when drilling a cored hole, and produced holes within the requirements of the job. The deep flutes gave ample chance for water to reach the cutting zone, and the thin center permitted the boring of crooked cored holes with a notable absence of strain or wedging.

Lifter for Planing Tools

By E. A. Dixie

Most of us are familiar with lifting devices such as the strap hinge, piece of leather, or clock spring used between the tool and the clapper block of a planer to lift the tool from the work on the return stroke, all of which are excellent for deep lifts such as are



DEVICE FOR LIFTING AND HOLDING PLANING TOOL

necessary when one is planing T-slots; but with work of this character the lift is high and the gibs of the toolslide are not very tight the drop at the end of the reverse stroke is apt to jar the tool and slide to a deeper cut. For this reason many operators prefer to lift the tool by hand, especially on particular jobs, as they can then lower it to its cut as gently as they please.

However, on long work it is tedious to hold the tool up for the duration of the return stroke and in the illustration is shown a simple tool lifter for such work.

It consists of a rectangular piece of machine steel or cast iron *A* which is drilled a loose fit for one of the studs in the toolblock. A setscrew provides means for securing it in place when once set.

On one side it is drilled and tapped for a $\frac{5}{16}$-in. machine screw upon which the member *B* is swung. This part may be made either of wood or metal, the one shown being of wood. The short end is cam shaped.

During the cutting stroke the handle stands vertically and the tool is in cutting position. When the cut reaches the end of its stroke the operator pushes the handle down to a horizontal position and the cam in contact with the stationary part of the clapper block lifts and holds the tool up until the end of the return stroke is reached.

Lifting the handle then lowers the tool gently to its former position. Thus the device requires the attention of the operator only at the ends of the stroke and the tool can be lowered to its cut as gently as the operator desires.

Setting Nuts by Power

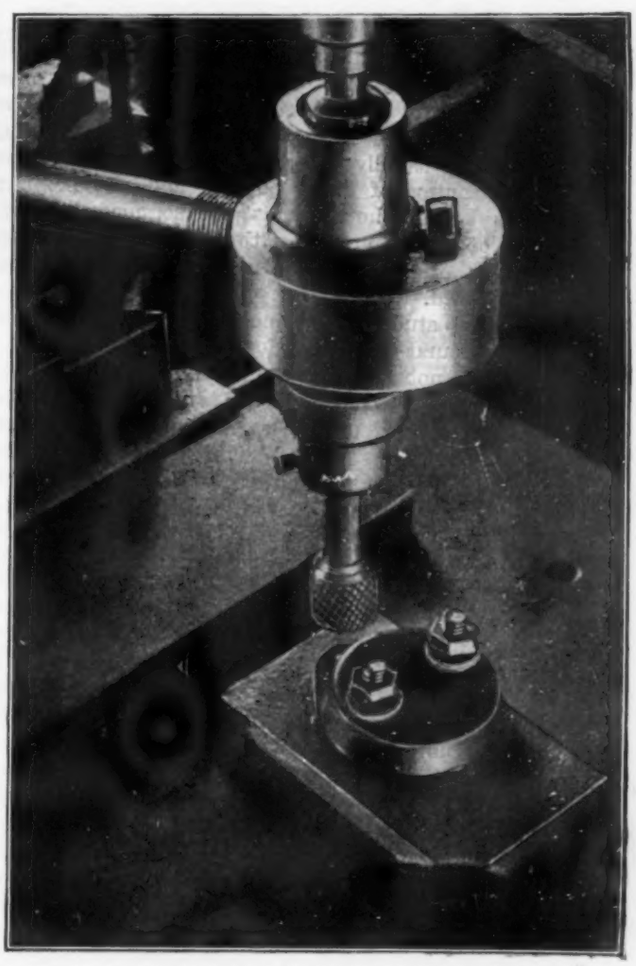
By Amos Ferber

In a shop manufacturing electrical devices there was a job of setting up the brass nuts of the connectors on the back of some of the manufactured articles.

There were hundreds of thousands of these nuts to be put in place; the length of stud was two or three times the thickness of the nut to allow room for wire connections, and the nuts must be set up tight so that they would not jar loose in transit.

The nuts have to be started on the studs by hand in any case but to turn them down, pick up a wrench and tighten each one, was a tedious job. It was the work of but few minutes to saw off a socket wrench, put it in an ordinary tapping head, and adjust the friction to run the nut down to the right degree of tightness.

With the arrangement shown in the illustration an operator can handle more work in an hour than was previously done in a day, and with infinitely less fatigue and blistering of the fingers.



SETTING NUTS WITH TAPPING HEAD

Waste and Salvage

By E. F. CREAGER

There are no more important items in shop management than the prevention of waste and the salvage of work which may be made serviceable by minor repairs. Much waste can be eliminated by careful designing which, after all, is the basis of economical manufacture.

I ALMOST said "prevention" and "elimination" which should mean 100 per cent cure. We cannot reach so high a figures as long as the human element is in contact with the operations. A careful study of the subject shows that too little attention is paid to the scrap pile. Big production demands efficient methods, and in investigating results in manufacturing plants I first ask to see the scrap pile. This usually gives a clue to the efficiency of the weakest department.

Recently, owing to high labor and material costs, owners have been giving more attention to the subject of waste, but the amount of complacency with which many of them are still viewing the situation is remarkable.

"The blindness of men is the most dangerous effect of their pride; it seems to nourish and augment it; it deprives them of knowledge of remedies which can solace their miseries and cure their faults."—LaRouchefoucault.

The Waste You Can Never Salvage—Time

It costs money to run your shop right, but it costs a lot more not to, and of all waste, *time* is the most important factor. We can replace a lost piece but we can never replace a lost minute. Wasted time is much greater than is usually given credence. A prompt start at the beginning of work periods and not stopping operations before shop signals are sounded, are two essentials of time saving. In these days of high labor cost neglect of these items is more expensive than usually realized.

In a recent study of this subject in three different factories, I found that operations and production began to slow up, not 5 or 10 min. before the whistle or gong sounded, but actually 45 min. before. This was proved by taking hourly productive records and power-meter readings. The meter readings showed that the peak load was not reached until 30 to 40 min. after starting and began to fall off slightly at 45 min., and very decidedly at 30 min., before stopping time.

Machine tools not run at their proper speed is another frequent cause of lost time. A hard lot of castings is received and the machine is slowed up but never "put in high" again.

In one instance I speeded the main line shaft 50 r.p.m. without the knowledge of the department foreman and had no complaint from him or the men, but did have a noticeable increase of production. Many factories permit "clean up" periods just before quitting time, but I have never known this to produce 10 per cent of anticipated results.

In one factory I was connected with, female employees were allowed 10 min. grace before the men in leaving the factory at noon and evening, and 10 min. additional on each weekly pay day. Each day the factory departments were swept up during working hours, the average lost time per operative was 5 min. on this. This gave a yearly loss on 500 female operatives of approximately 66,000 working hours at 20c. per hour, approximately $13,000, eliminating the usual lost time before quitting and ignoring the fact that the men in the department quit work at the same time the girls did.

It was not hard to see that providing a separate exit for the women and separate pay windows on pay day, provided the needed segregation at the congested hours. Sweeping at night cut out the disturbing expense incident to doing this in the daytime.

Assigning Work Promptly

Another very large factor in loss of time and production is in not properly or promptly assigning work to the operator, with the result that as the job nears the finish the operator drags or "stalls" until quitting time. A working knowledge, and records of machine-tool capacity, will largely eliminate this if properly utilized.

In plotting the productive machine-tool hour capacity versus the production per hour in a recent case, I found that the production was only 40 per cent of the total capacity. The chart used showed these results; tardiness, 10 per cent; absent operators, 10 per cent; machine break-down, 2 per cent; lack of stock (next order not promptly assigned), 10 per cent; out of material, 5 per cent; machines running below speed and cuts under capacity, about 20 per cent; indifference and lack of pep, 25 per cent; lack of proper fixtures 25 to 50 per cent; defective castings and unnecessary work, 20 per cent. These can be rearranged to suit your individual case, but they affected approximately 60 per cent of those in the plant in question. These conditions have been more than proved for after correction and within the past six weeks, the production has been increased from eight sets of machines per month to sixteen, and will be increased to twenty during the current month. I could cite many other instances and their corrections. But I know from practical experience how hard it is to convince the average manufacturer that "such conditions exist in our plant."

Begin Saving by Having Designs Right

I believe that better education of the employees on these points is the best solution, and managers are awakening to this fact. Too few managers appreciate just where to begin saving. The proper place is in machine design, in the engineering department. It is so easy to execute some cute little apparent saving on the drafting board, which gets into production in many cases because the practical man in the factory is denied the right to even suggest a change on anything approved by the engineers.

I found in one factory that 20 per cent of certain castings was rejected after partial machining because of "dirt" showing up on the working face, caused by trying to save 1 lb. of metal in 75 by casting a narrow groove the full length of the piece. In pouring, the small sand projection washed away; result, no saving in weight and a "dirty" casting.

Another instance was the casting in of four tubes as oil ways, to save drilling four holes. Owing to the position of the tubes a special flask was required, which increased the cost of the casting 2c. per pound. Special core prints were required to locate the tubes, steel tubing with thick walls was also required, since the mass of the casting melted ordinary iron pipe. For tubing, core prints, and special work the cost was $1.59 per casting; for extra flasks and time in molding the cost on a casting weighing 125 lb. was $5. The actual cost of drilling these holes is 10c. each or 40c. per casting, but they had been paying $6.59 for saving this operation.

A cored slot was cast in the same piece to save 10 min. planing time. But the work had to be "set up to the slot" and the planer hand was taking 30 min. to do this. Since the slot has been eliminated he sets up and planes three pieces in less time than he formerly did one. An assembly fixture that was used in only one position had an adjustable graduated base. The designer said that "some day" they might want to use it in "some other position."

In one plant a collar was required on a shaft to prevent an assembly from shifting. The shaft diameter required was ¾ in. The stock that used to make the collar integral with the shaft was 1¼ in. By making the collar separate and swaging it into a neck on the shaft, saved this firm $150 per day in material alone, not considering the expense of removing the unnecessary material.

An Automatic That Did Not Save Money

Recently, I was proudly shown an automatic punch-press outfit, producing a complete set of stampings at one stroke of the press. It would have been automatic had it not required two operatives to attend it, and had the work not required a flattening and a tumbling operation to remove the burr. If the speed had been 150 strokes per minute instead of 60, a larger quantity could have been produced.

I was told that the dies had cost $2,800, and that they could not be worked a full day without taking them down for grinding and readjustment. This usually took place at the end of a 6-hr. run and about 3 hr. were required to "set up" again after grinding. I have done the same type of work in an ordinary press at 150 strokes per minute with hand feed. No burring or flattening was needed and the dies could be taken down, ground and reset in less than 1 hr. with a "run" of 75,000 to 100,000 pieces between grinds. The cost for the complete die set was approximately $650.

In the same shop I saw disks being flattened by hand on a surface plate in 1 to 3 min. each that could have been done in a press at the rate of fifty per minute.

Not Exceptional Cases

I know that many readers will say that these are exceptional cases, but they are now occurring, or have occurred, in plants of wide reputation, which shows that some executives are not locating the hidden leaks of that important factor, *time*, as well as of material not actually required.

I remember an eastern promotor's advertisement some years ago of a "pound of screws from a pound of wire." While we cannot all do as well as this, we can come much closer than many of us are doing now in conserving time, material and effort, and seeing that when we spend the firm's money we get all we can for it. Education, not only for the operative but for the executive, will prove to be a large factor in reducing your scrap heap. I am a great believer in making all jigs and fixtures as nearly complete and self-contained as possible. In many instances they can be made to do the inspection of castings or operations previously done. This eliminates the chance of bad work going through the succeeding operations, and finds defects at a primary stage. Inspection is frequently carried to excess and some managers seem to think that an inspection department and a bunch of men with an inspection badge is all that is needed to produce perfect work. In one instance I know of where the inspection force was doubled, the salvage or scrap account increased 25 per cent. Production decreased approximately 10 per cent. because so much work was delayed by inspection, but the percentage of defective finished articles remained the same.

An intelligent inspection between and during operation, floor inspection, an inspection of assemblies as made, and a final inspection of the completed article appears to produce best results.

A "salvage department" through which *all* material must pass before it finds its final resting place in the scrap heap, is essential to economical handling of the matter. Many times I have found defective material in the scrap heap that should have been returned to the maker. When properly conducted and with prompt comprehensive reports to the front office, such a department will assist in locating the cause of much of the defective work. Discover the *cause* of your losses and then *correct* them. Begin at the source of your possibilities, the design. Follow through the pattern making and tooling, and organize your salvage department with a good man at the head of it. Then organize the intermediate sections of the work. Inspect at proper

intervals during the progress of the work. Educate the operative to the enormous expense of bad work, to the fact that a spoiled piece requires another one to replace it, and that the expense of replacement depends upon whether it is found in your factory, or by your customer in Portland, Ore., or in Hindustan.

As to percentage of wastage through spoiled material and defective work, 5 per cent is considered a conservative figure; more plants are running over than under it. I have seen this figure kept as low as $\frac{1}{10}$ of 1 per cent, as the average for the entire factory. Each factory, or type of production, has a base that may be taken as normal but which depends largely on the article produced.

Johnson Plans to Store Labor

BY JOHN R. GODFREY

Johnson seems to have taken a new lease of life since he took hold of the shop actively, after firing the firm of high binders who worked out a real 100 per cent scientific Santa Claus for him. He's looking better and is sure doing some good work for a man of his years. If he wasn't young inside he'd be content to let things run along in the same old way. But he's going to leave a real business built on a solid foundation for that son of his.

Just now he's figuring on keeping his men busy when the present boom in gas motors slacks off, either from sympathy with other things, or from a lack of fuel which the oil men tell us isn't so far off. Of course it isn't good form to even hint at a slackening of business, but Johnson and everyone else knows that business, like typhoid and politics, goes in cycles. He knows that the present boom can't last always without a sag in the sales curve, and he's planning as to how he'll meet it. When I dropped in the other day he was figuring furiously with pencil and pad and then making notes of the results.

"Don't think I'm a calamity howler Godfrey, but you and I are both too old not to know that every high tide has its ebb. Now I believe it wiser not to pretend that it will never ebb *this time*, but to make some plan that may act as a shock absorber when the time arrives.

"The great trouble usually comes from a bunch of fair weather optimists who tell you to believe the boom will never end, getting cold feet the minute orders slack off and shutting down their plants cold. They holler about being patriotic and not even *thinking* of a slacking off, but they don't risk a cent in building stock when the slack time comes.

"What I'm trying to figure out is what parts of our motors have the most labor and the least material. The thing I'm after is to keep from laying off men. I want to be able to keep every man going; what I dread most is having to tell my men that we can't keep them at work. I'm going to have all plans made so as to build stock on standard parts. I'm going to store labor instead of material. Then when the business comes back we can assemble complete motors in a hurry.

"You remember how our old friend F. E. Reed used to build lathes for stock during every dull period. Stocked Worcester full of lathes while all the other builders were working short handed or not at all. Sold 'em all too—you remember when the demand came back. Had 'em all ready to deliver in bunches when they were wanted. And the other fellows kicked themselves for not having any lathes to sell. I figure that there's no safer investment in business than in the standard machines you build—and I've got faith enough in this old motor of ours to tuck away parts of a lot of them.

"But it isn't all with the idea of making a *killing*, Godfrey, because it isn't dead sure how costs of material are going to be next year. What I want most of all is to keep the shop family together—to keep every man on the payroll. Whiting Williams tells us that the prayer of the average worker, particularly the unskilled worker, is 'give us this day our daily job.' And when I look back at the panic of 1892 to 1894, I can readily believe it. I counted ties myself that year and there ain't a darn bit of fun in it. Don't know of anything that will make a man see red any quicker, specially when he also sees a limousine roll by with a fat gent in a high hat, or a bejeweled damsel with a pug dog.

"Heard Otto Kahn, the banker, a while ago and he told us frankly that in times of stress we must keep the men working, even if we don't make a cent ourselves. Not much like the banker talks in the old days when we were younger—but it's a darn sight better in many ways.

"I'm hoping some others in this town have some thoughts along the same line."

Motor Gasoline Survey

In a report written by N. A. Smith and C. R. Bopp and published in the Monthly Reports of Investigations of the Bureau of Mines for February, 1920, the results of a recent test upon the volatility of gasoline used as motor fuel throughout the country are given.

In seven large cities, each in a different district of the country, samples of gasoline of the kind that was being sold to motorists for fuel during January, 1920, were analyzed. The data taken comprised the specific gravity at 60 deg. F.; the corresponding Baumé gravity; the first drop or initial boiling point; the 20, 50 and 90 per cent points; the end or dry point, the average boiling point, and the percentage recovered in the receiver. The values found were checked against those taken in a similar test made in April, 1919, and against the specifications used in the purchasing of motor gasoline for Government use. These specifications were adopted in November, 1919, after being drafted by the Committee on Standardization of Petroleum Specifications.

The comparison of the results of the two tests shows that the average quality of the gasoline on the market in this country varied but little during the period between April, 1919, and January, 1920. Furthermore, the average volatility of the gasoline was somewhat higher than that required by the Federal specifications. These points are presented in the original article in the forms of both tables and curves. In some of the tests it was found that the samples contained an excess of low-boiling fractions, probably due to an admixture of too large an amount of "casinghead" gasoline. Other samples showed too great a volatility at the upper part of the distillation range, a condition which is often due to the use of an excess of high-boiling naphtha in blending.

The article concludes by urging the refiners to exercise greater care as a means of bettering the quality of motor gasoline.

Something New in Automotive Articles

IN this issue we begin a series of automotive articles arranged in an unusual manner. It has been the general custom to publish manufacturing articles of various kinds as they were obtained, regardless of their bearing on any similar articles from other shops.

We have realized for some time that in certain lines—and especially in the automotive field — the old method of handling articles from different companies did not give the production manager, engineer or designer information in a form most convenient and available for study and subsequent reference.

For this reason we gathered, under the personal direction of Fred H. Colvin, Chief Field Editor, an enormous amount of material on the machining and handling of various automobile parts from a considerable number of shops.

This material has been arranged so that we can group articles describing certain parts from different concerns in one issue.

For instance in this issue we show motor-cylinder work as done in the shops of the Cadillac, Chandler, Franklin, Packard and Peerless companies.

In subsequent issues will be grouped articles on piston work, connecting-rod work and other important automobile parts.

Never before, we believe, has such live material been placed before the automotive engineer in such accessible form.

Details of machining an material handling are shown that only close study can bring out, and that few have either the time or opportunity of doing. It amounts to an exchange of ideas between some of the best automotive engineers in the world on subjects on which they are experts.

No one who has anything to do with the manufacture or handling of automobile parts can afford to miss the opportunity to study the latest practice of some of the greatest factories in the world.

The machine-tool builder will also find in these group articles an opportunity to study out methods whereby his machines may best be applied to the work.

Thos. Viall

Editor

EDITORIALS

Getting Time to Read the "American Machinist"

FINDING time to read—or not finding it—is largely a matter of habit. We've had some pretty positive notions on this but feared they might be biased. But here's what an old reader writes us:

"When I hear a man say he hasn't time to read the *American Machinist*, or if I find unopened copies on his desk, I know he isn't the man or the manager he might be and ought to be. I often think of the *American Machinist* as I do a fine micrometer or a set of "Jo" blocks. You don't use them all the time nor for all purposes. But the man who keeps a set of either on his desk, unopened, would hardly be called efficient.

"Every business man reads his daily paper—sometimes two or three. Yet it is safe to say that not 10 per cent of the time spent benefits his business. I read my *American Machinist* much the same way as I do the dailies. I run over the headlines—if one interests me I read the synopsis. If it's along the line I want I read the article.

"I don't try to read the whole paper. If I find one or two articles in my line, I've got more than my money's worth. The other articles are of equal value to some one else, because you cover a wide field."

The man who doesn't take time to know what the *American Machinist* prints in his line every week is letting a good tool lie idle—his overhead is too high.

Another friend who has subscribed for the paper for years was chagrined to find that his friend Chordal had written several of his old-time articles during the year and that he had missed some of them. He had thought himself too busy to read—when in reality he had just got out of the habit.

Don't lose the habit of looking over every issue—you're sure to miss something.

To help you to pick out the articles you want to read we are introducing a "readers' page" which is intended to bulletin the contents of the issue and to supplement the regular contents page. It begins with this issue.

Manufacturing Tools in the Shop

TEN years ago no shop was considered complete without a well-equiped toolroom. This meant a large variety of machines capable of handling almost any kind of work. Such an equipment is undoubtedly justified in shops having large mass production, such as automobiles, machine tools, or other products. But for shops whose business is the making of tools for others, the toolroom seems to have no place as a separate department. The tools for home use should take a shop order and go through the shop in the regular way.

Small shops of any kind, except tool shops, can very often save time, trouble and expense by having their tools made by a reputable contract shop which specializes in tool work. Even some of the large shops find it more profitable to do this than to maintain a toolroom of their own.

All sides of the question should be carefully considered before deciding which is the best policy, not forgetting that toolroom machines are not, as a rule, used as continuously as those in the productive part of the shop.

Foundation of Economical Manufacture

ECONOMICAL manufacture depends upon many things, including proper machine equipment, suitable jigs, fixtures and tools, correct cutting speeds and broad-visioned management. The foundation on which economical manufacture depends, however, is too often overlooked—that is, the design and the specifications to which the article must be made. For without a design as simple and as easily machined as possible, and specifications which do not demand unnecessary labor and expense, no manufacturing can be done on a truly economical basis.

The article by E. F. Creager on Waste and Salvage in this issue brings out this important point very clearly. Economical manufacture must begin with the design; otherwise, it is impossible to secure best results.

Mr. Creager also shows how the practical shop man can assist in making the design easy to manufacture, emphasizing the benefit to be gained by having regular channels by which this practical advice can be easily secured. No matter what the method, whether by committees or direct consultation with the men most familiar with the work, the results cannot fail to be gratifying when co-operation is really secured.

The designing engineer can work out many problems which would be impossible for the man in the shop. But when it comes to deciding on coring a hole, or casting slots or projection to save planing, as compared with leaving it to be machined, the man who will actually handle the job can often save the firm real money if consulted before the work goes too far. We need the combined intelligence of the shop to secure the very best results.

The Danger of Inadequate Housing Facilities

THE final report of the President's Industrial Conference sounds a warning regarding the intolerable housing situation in many of our large cities.

What building was done during the war was confined to the enlargement of existing manufacturing plants or the construction of new ones. Little thought was given to the houses needed for the many new workers which the big plants would employ, and consequently some of them will either be without homes this spring or the victims of rent profiteers. This is essentially a community problem, but the manufacturer is vitally concerned and it will pay him to offer prompt co-operation to the public bodies struggling with the problem.

SHOP EQUIPMENT NEWS

-Edited By-
E. L. DUNN and S. A. HAND

SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and • equipment •

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

• CONDENSED • CLIPPING INDEX
A continuous record of modern designs • and equipment •

Betts-Bridgeford 9-Speed Geared Head

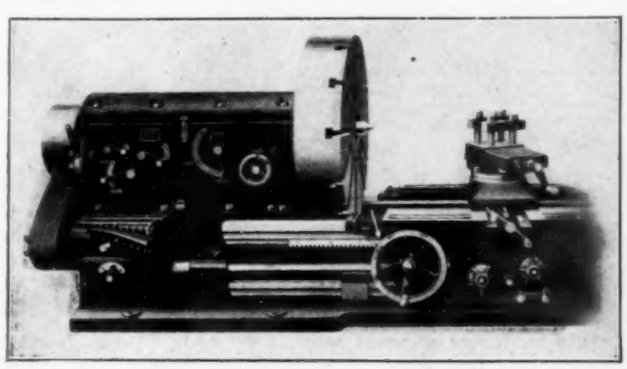
To meet the present-day requirements an all-geared head has been designed by the Betts Machine Co., of Rochester, N. Y., and applied to its full line of heavy-duty engine lathes from 32 to 48 in. swing.

The headstock, shown in the illustration, is of the all-geared inclosed type and is operated from the apron by a powerful expanding ring friction clutch upon which is mounted the driving pulley. The same movement which disengages the clutch automatically applies the friction brake, thereby stopping the machine instantly. The nine spindle speeds are of the selective type, three direct, three back gear, three triple gear, and are obtained and controlled by three conveniently located levers on the front of the headstock.

All speed changes are in geometric progression and are obtained through hardened-steel sliding gears and positive clutches running in oil. The edges of the gear teeth are rounded to allow for instant and easy engagement.

There are 12 gears including the faceplate and pinion gears. All back- and triple-gear speeds are through faceplate gear, the driving pinion of which can be disengaged when using direct-spindle speeds. An interlocking device is provided so that no two speeds can be engaged at the same time.

All shafts and gears are located in the base of the headstock, thereby allowing easy access, it being necessary only to remove the cover. All shaft bearings are bronze bushed, and lubrication to bearings is obtained by a pump located in the headstock which distributes oil to all of the bearings, eliminating the possibility of any bearing running dry, it being necessary only to keep the oil at the height designated. When the machine is motor driven, the motor is mounted on top of the headstock cover and direct connected through gearing to the main driving shaft.



BETTS-BRADFORD 9-SPEED HEAD

Streine Toggle Type Forming Press

The Streine Tool and Manufacturing Co., New Bremen, Ohio, has brought out the forming and roofing press shown in the illustration.

This machine is designed for making all kinds of roofing and special shapes in any length, up to twelve feet and has a large die space which enables the operator to use dies of most any description.

It also has four removable wooden tables which are supplied with gages on both sides of the machine. This makes it possible to work two kinds of dies in one operation.

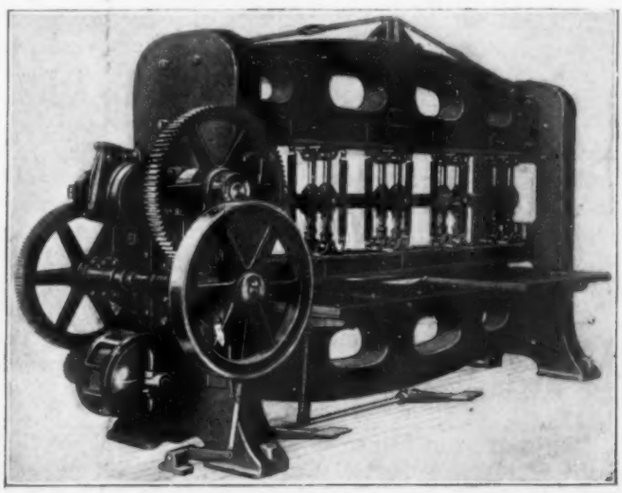
The dies can be removed either from the side of the machine, or from the end. The table arms are of a height so as to bolt gages by removing the wooden tables. The dies are located in the machine by means of tongue and groove, which assures their being in alignment at all times.

The forming bar and hold-down bar are well balanced with springs. The toggles and shoes are accurately finished, allowing the machine to work very smoothly.

The machine is also fitted with machine cut gears and with a positive clutch.

The eccentrics are made of steel and keyed to the eccentric shaft. They are very large in diameter and have a wide face, thus having a large bearing surface.

The machine is also fitted with a box type cam which is keyed to the eccentric shaft. This makes it possible to use a die under the hold-down bar for the forming of light gages of metal.



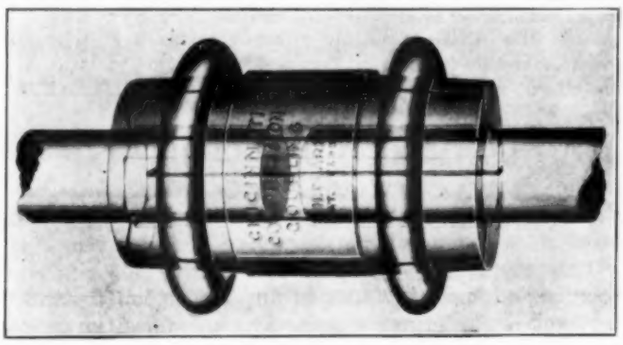
STREINE TOGGLE TYPE FORMING AND ROOFING PRESS

Cincinnati Compression Coupling

The Cincinnati Ball Crank Co., Cincinnati, Ohio, has placed on the market a coupling of the compression type as shown in the illustration herewith.

This coupling consists of five parts—three jaws and two clamping rings—and the only tool necessary to apply it is a hammer.

In applying the coupling the jaws are placed around



CINCINNATI COMPRESSION COUPLING

the shaft and held in position by notches and corresponding projections. The forged clamping rings are then pushed over the tapered ends and hammered tight.

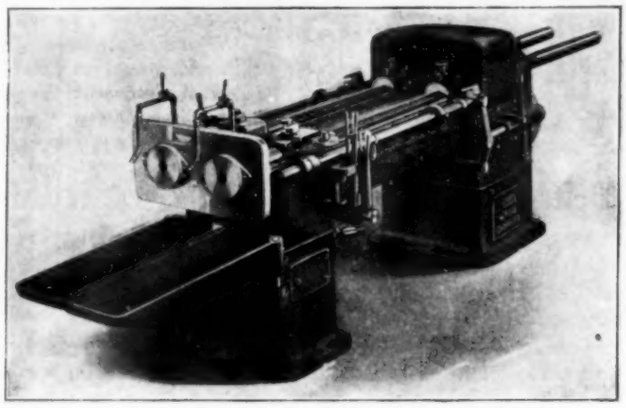
The assembled coupling forms a compact shaft-joint and there are no projections to catch a workman's clothing. When shafts of two sizes are to be coupled, the only additional parts needed are three strips of cold-rolled steel of the proper size to fit between the smaller shaft and the jaws.

The coupling is made in standard sizes from ⅝ to 3 inches.

Lapointe No. 3 Duplex Broaching Machine

The Lapointe Machine Tool Co., Hudson, Mass., is now manufacturing, in addition to its regular line of broaching machines, a double machine known as the No. 3 Duplex. The machine is intended for use in factories where production is handled on a quantity basis and where floor space is limited. The machine is heavily built and conveniently arranged for operation. The power is controlled through the medium of a patented clutch that furnishes a positive drive, and is easy to operate. The two screws act independently, the drive and control for each being entirely separate, they may be used singly, or both together, and by regulating the speed, two broaches of different lengths may be used at the same time. Both screws are controlled from the right-hand side of the machine, and the left-hand screw has an additional control lever on that side, permitting independent control from either side of the machine. Two cutting speeds of 39 and 74 in. per minute are provided for each screw, and the especially fast return speed of 196 ft. per minute assures a minimum amount of time lost during the return stroke. Large roller bearings are employed for the thrust, and the driving nuts are 10 in. in length.

The gears run in one direction, are submerged in a bath of oil, and completely inclosed. An oil gage on the outside of the gear case registers the amount of oil. The draw-heads are made from steel billets; they have extra long bearings on the slideways to prevent possible chatter, and are fitted with renewable bronze shoes. A reservoir is located in the front pedestal of the machine, from which a steady stream of lubricant is supplied to the work by a No. 4 Brown & Sharpe pump. The machine is provided with a single driving pulley, mounted on ball bearings; is easily adapt-



LAPOINTE NO. 3 DUPLEX BROACHING MACHINE

Specifications: Size, No. 3 double-screw. Capacity, will cut keyways up to 1¼ in. wide, or broach square holes up to 3 in. across flats from drilled holes in steel. Maximum stroke, 50 in. Holes in faceplate of machine 5 in. (Center distance between holes 13 in.) Driving screws 2¾ in. in dia., 1¼ Acme threads per in. Length of driving nut 10 in. Driving pulley 19 x 6½ in. Pulley speed 450 r.p.m. Speeds; fast cutting, 74 in.; slow cutting, 49 in.; return, 196 in. per min., vertical adjustment of draw head 1⅛ in. below and 1½ in. above center of faceplate. Floor space, allowing for travel of screw and broach, 180 x 28 in. Motor size recommended 15 hp.

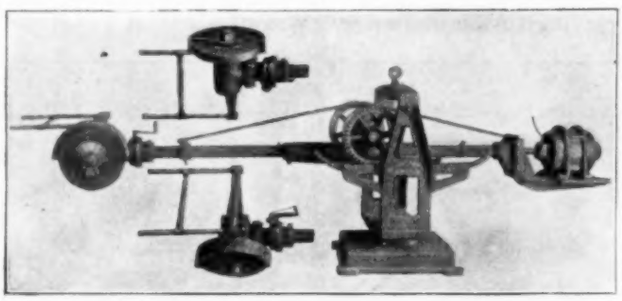
able to motor drive, and when thus specified the motor is mounted on a bracket at the side of the machine and connected to the drive shaft by means of a silent chain.

Mummert-Dixon Portable Radial Grinding Machine

The Mummert-Dixon Co., Hanover, Pa., has placed on the market the portable radial grinding machine shown in the illustration herewith.

The machine is self-contained, the frame being mounted on a substantial base. The trunnions connected with the frame are mounted on balls making the movement very easy.

The head can be revolved by means of a convenient crank handle operating through worm gearing and can be held at any angle.



MUMMERT DIXON PORTABLE RADIAL GRINDING MACHINE

Specifications: Grinding wheel; face, 3 in.; diameter, 20 in.; hole, 2 in. Speed of wheel arbor, 1,000 r.p.m. Motor, hp., 7½; speed, 1,200 r.p.m. Length of arm, trolley to head, 7 ft. Working area; annular 36 in.; radial 6 to 8 ft. Dimensions; height over all, 5 ft.; length overall, 13 ft. Weight with motor; net, 2,600 lb.; crated, 2,800 lb.; boxed for export, 3,000 lb.

The grinding head and the trolley cross-shaft are both fitted with ball bearings, which, together with the large track wheels, provide easy movement.

The grinding wheel is driven by motor, through bevel gears which are inclosed in a tight case packed with transmission grease.

As the weight is suspended below the center of the trolley cross-shaft and as the head and motor counterbalance each other, the arm naturally assumes a horizontal position.

All moving parts except the lower half of the grinding wheel are inclosed.

The motor mounting can be adapted to any type or style of motor. The motor control can be mounted on the side of the frame, but as this makes a rather cumbersome arrangement it is usually mounted on the wall or on a near-by post or column.

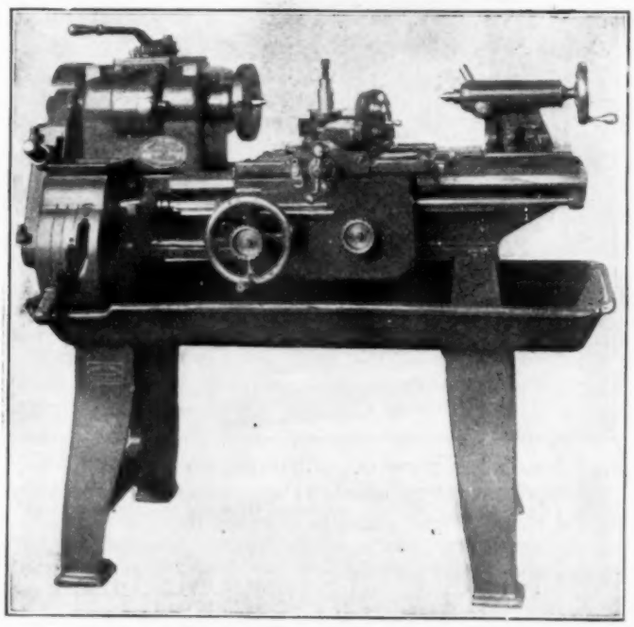
Adams Short-Cut Lathe

The O. R. Adams Manufacturing Co., Inc., Rochester, N. Y., has placed on the market the lathe shown.

The headstock has six changes of speed, ranging from 43 to 375 r.p.m. and speeds can be changed while the lathe is in operation. When the starting lever is in the neutral position the spindle is held by a brake. The spindle runs in taper-bronze bearings and the thrust is taken by self-aligning ball bearings. All gears run in an oil bath.

The feed-gear box is of the tumbler type and provides for four changes of feed from 0.006 to 0.025 in. per revolution, and by changing gears at one end of the lathe a second ratio of feeds from 0.010 to 0.042 is provided for.

The gear case at the end has reverse gears for changing the direction of the feed as well as an intermediate gear for changing the ratio. The apron is of the double-plate type and is provided with multiple-automatic stops which operate a jaw clutch on the feed rod.



ADAMS SHORT-CUT LATHE

Specifications: Swing, over bed, 13⅝ in.; over carriage, 7⅝ in. Distance between centers 20 in. Length of bed 48 in. Weight 1,350 lb.

The carriage is provided with shear wipers both in front and rear and can be locked in position when using the cross feed. The tool-block base is so designed that it can be used for either a plain or a compound rest. The compound rest operating-screw is offset, making it impossible for the cross-feed and compound-rest handles to interfere. The compound-rest base is graduated in degrees and both cross-feed and compound-rest screws are graduated to 0.001 in.

A taper attachment can be supplied and will turn tapers up to 1½ in. per foot, the whole distance between centers. Other extras include front and rear tool blocks, back forming attachment and draw-in-chuck. Motor drive can be arranged for. It is claimed that this lathe will take a cut equal to that of a standard 16-in. lathe.

Brown Precision Portable Potentiometer

The potentiometer illustrated has been developed by the Brown Instrument Co., Philadelphia, Pa., to permit the exact measurement of all e.m.f.'s required in pyrometry. While its use is not restricted to such measurements, the ease with which it can be operated makes it specially serviceable for checking millivoltmeters and potentiometers and directly determining the e.m.f.'s of thermo-couples.

The limit of accuracy in an instrument of this type is determined by the scale length, usually about 10 in. If a 10-in. scale is calibrated to 50 millivolts, one millivolt will have a length of one-fifth of an inch. The scale of the Brown potentiometer is nearly 96 in. in length. With a range to 50 millivolts each millivolt is nearly 2 in. in length, graduated to one-fiftieth of a millivolt.

BROWN PRECISION PORTABLE POTENTIOMETER

The potentiometer has a drum wire of 150 ohms resistance and the total instrument resistance for 50 millivolts is approximately 4,000 ohms, including rheostats. This is gradually reduced to a minimum of about 3,400 ohms, when the dry cell is exhausted and must be renewed. The current required to operate the Brown potentiometer is never more than 0.00036 ampere.

Browning Quenching Machine

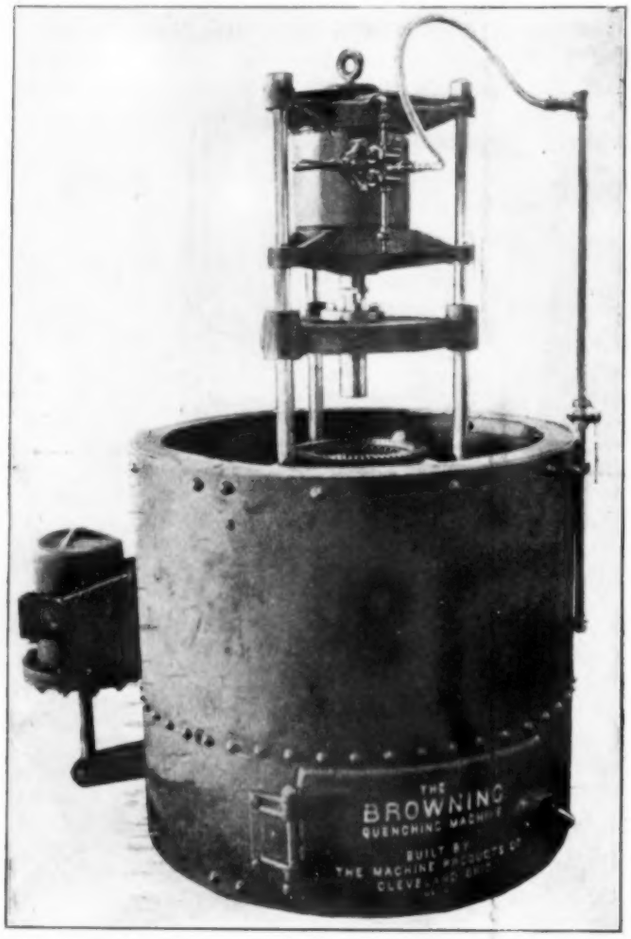
The Machine Products Co., East 179th St., and St. Clair Ave., Cleveland, Ohio, has brought out the Browning quenching machine illustrated herewith.

This machine was developed to prevent the warping of gear blanks while being quenched after heat treatment. A liquid-tight diaphragm is placed above the bottom, the portion above being used as a tank for the quenching fluid. Two die castings are provided to which special dies made to fit the gear blanks are to be fastened. The gear blank is clamped between the dies by compressed air controlled by a four-stage valve.

The clamping cylinder is at the top and its alignment is assured by three rods fastened to the cylinder heads and to a casting secured to the diaphragm, the rods also serving as guides for the upper dieplate. The submerging cylinder is held at the side of the tank in a trunnion casting which allows it to adjust itself to the necessary position. Air is furnished through one of the trunnions. A lever connects the piston rod of the submerging cylinder to a vertical rod passing through a stuffing-box in the diaphragm. The lower die is fastened to the die casting on this vertical rod while the upper die is fastened to the die casting secured to the piston rod of the upper cylinder.

With the four-stage valve in the first position both dies are raised out of the liquid. In the second position the upper die is still further raised and at this time a gear blank can be placed on the lower die. In the third position the upper die descends, clamping the gear blank between both dies. In the fourth position the dies and gear blank are submerged.

The door in front is for access to the stuffing-box and all mechanism below the diaphragm. Pipe connections are provided for attaching the tank to a refrigerating line for cooling and circulating the liquid. The machine is 42 in. in diameter and 38 in. high.

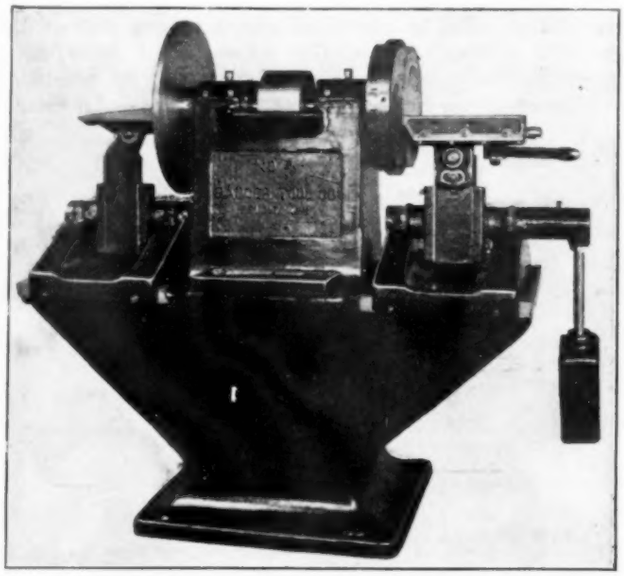


BROWNING QUENCHING MACHINE

No. 4 Badger Grinding Machines

The Badger Tool Co., Beloit, Wis., has added to its line the No. 4 grinding machine shown in the illustration. The spindle is mounted in both radial and thrust-ball bearings and carries on one end a disk for abrasive paper and on the other end a chuck for a cylinder wheel. The table at the left-hand side is a plain swinging table while the one at the right is provided with a lever feed.

The machine can be furnished with dust hoods for dry grinding and with guards, pump and connections for wet grinding.

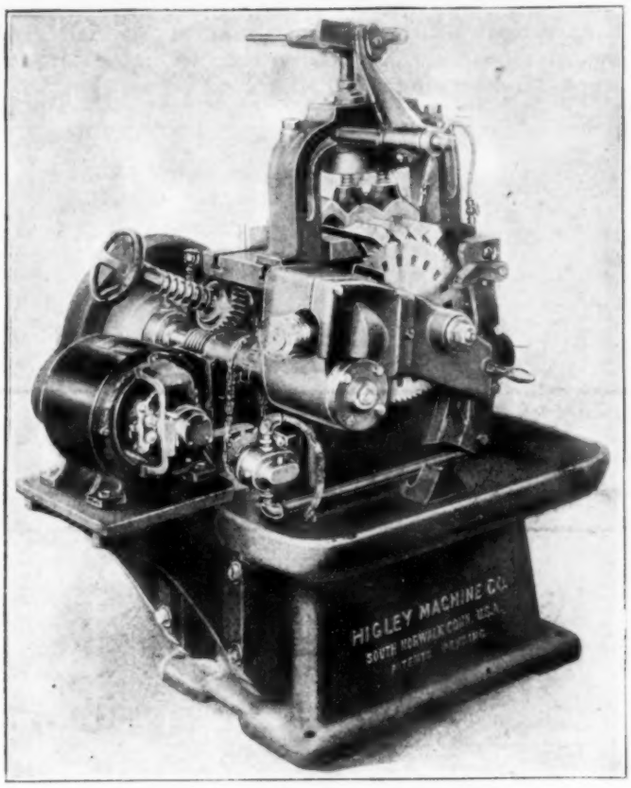


NO. 4 BADGER GRINDING MACHINE

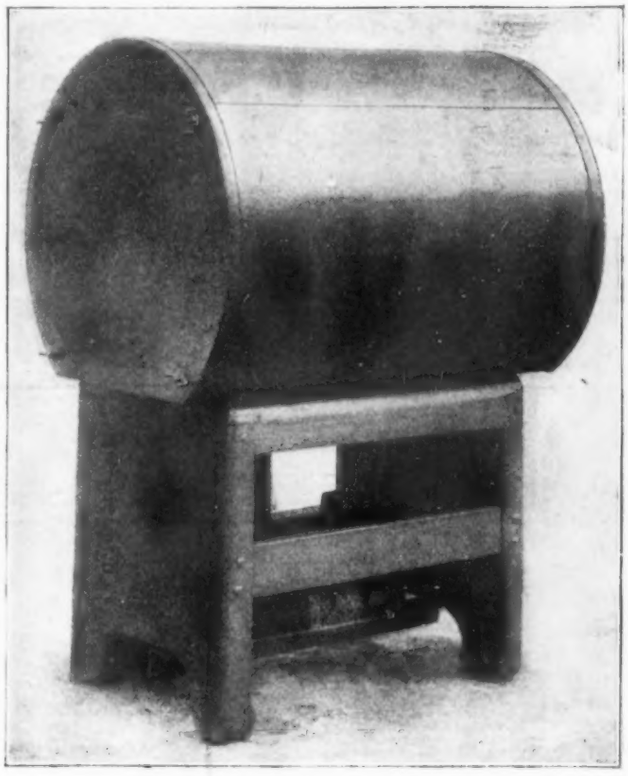
Capacity: Disk, 18 in.; chuck, 14 in. Diameter of spindle, 2 in. Pulley, 7½ x 4½ in. Weight complete with countershaft and press for gluing disks, 2,300 lb.

Higley Cold Sawing Machine

The Higley Machine Co., South Norwalk, Conn., with offices in the Singer Building, New York City, has added another sawing machine to its line. This latest model, known as the "11½ B" has a capacity up to 3 in. on either square or round stock. With the work clamps arranged as shown, four 1½-in. rods may be cut off at the same time and by shifting the V-plate on the table one-quarter turn, two 3-in. rods may be cut off in a like manner. The ¾-hp. motor is connected to the



HIGLEY COLD SAWING MACHINE



BERWICK ELECTRIC RIVET HEATER

drive shaft through heavy spur gearing. The shaft runs in bronze-bushed bearings and carries on its right-hand end a worm of hardened steel, meshing with a bronze gear. On the same shaft is carried the sprocket that is geared to the saw. The worm is provided with thrust bearings of ample size that are easily accessible. An automatic arrangement regulates the depth of the cut and returns the saw to its lowest position when the cut is completed. The machine base is used as a reservoir for the lubricating oil which is circulated by means of a vane type suction pump of large capacity. The machine is made for belt drive as well as for motor drive, the multiple clamping arrangement being furnished with either type.

Berwick Electric Rivet Heater

Electric rivet heaters of the type shown are manufactured by The American Car and Foundry Co., 165 Broadway, New York City. The design employs the step-down transformer principle and it is claimed that it reduces the percentage of spoiled rivets; that there is no smoke or heat, and but slight fire risk.

On account of the low voltage, there is no danger to the operator, either when placing the rivet in the heater or when removing the same. Plain, uninsulated tongs can be used, and it is not necessary for the operator to wear gloves or goggles to protect himself.

Each heating-unit in the furnace, called an electrode, consists of an open, flexible, secondary link, with two solid copper terminals called the jaws. The lower jaw is connected to a treadle which, when pressed down, makes an opening according to the capacity of the machine, into which is inserted vertically the rivet to be heated. This lower jaw ascends and holds the rivet firmly in place when the operator removes his foot from the treadle. It is through these jaws that the low-voltage high-amperage current passes to the rivet.

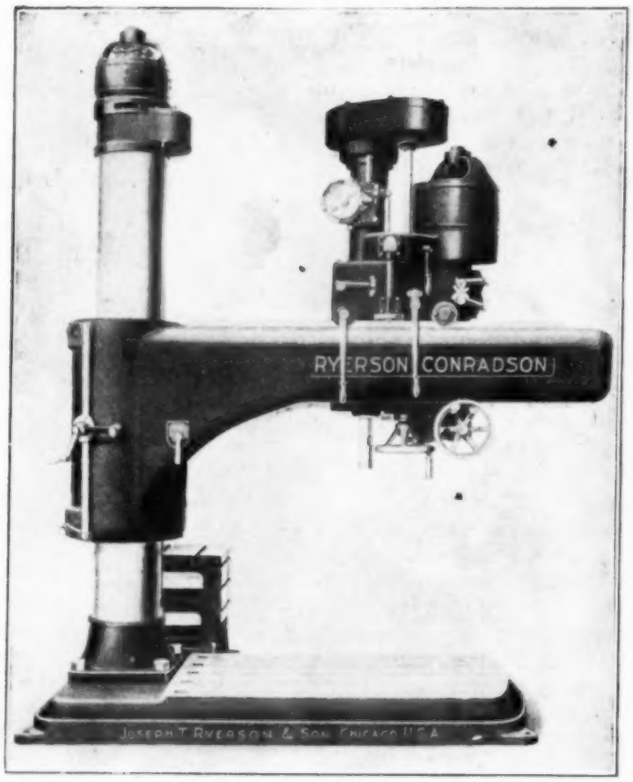
In addition to the service switch a heat-control device is provided, giving three changes, low, medium and high. Low heat is used for the smaller size rivets, or when only a limited hourly capacity is demanded. Medium heat is used for the intermediate size rivets, or for a larger volume. High heat is used on the largest size rivets, within the capacity of the machine; or when a maximum volume of the smaller sizes is required.

The heater is provided with chain-hooks so as to be lifted with a crane, the smaller sizes are fitted with wheels when required, and when so ordered a pressed-steel hood is furnished as a protection against the weather. The heater is made in a number of different sizes.

Ryerson-Conradson Plain Radial Drilling Machine

A radial drilling machine, known as the Ryerson-Conradson two-motor high-power radial drilling machine is shown in the illustration. It is being placed on the market by Jos. T. Ryerson and Son, Chicago, Ill. This machine is built in three sizes, with 4, 5 and 6-ft. arms. Among the principal features is the gearing which has been greatly simplified so that only four shafts and sixteen gears are required for the full range of speeds and feeds. The spindle and driving shafts are all contained in a single cast-iron box. Only spur gears are employed, eliminating bevel gears altogether.

The head is mounted on S.K.F. ball-bearing rollers and travels on the top face of the box-section arm to which it is held by a plate, guided by parallel V's on the under side of the arm. The plate also serves to hold the head in alignment with the arm. The ball-



RYERSON-CONRADSON RADIAL DRILLING MACHINE

Specifications: Built in three sizes, 4, 5 and 6 ft.; base height, 7½, 8½ and 9½ in.; base size in front of column, 36 x 53, 42 x 65½, 48 x 78 in.; vertical range of arm, 38, 42, 48 in.; horizontal range of head, 39½, 51½, 64 in.; maximum distance from spindle to base, 62, 70, 80 in.; minimum distance from spindle to base, 8, 10, 12 in.; number of spindle speeds, 16; range of spindle speeds, 19 to 310; number of spindle feeds, fine set, 8, range 0.005 to 0.078 in., coarse set, 8, range 0.023 to 0.370; motor, main drive, 5, 7½, 10 hp.; motor, elevating, 2, 3, 5 hp.; spindle, vertical traverse, 16, 18, 20 in.; bored to Morse taper, No. 5; total height, 120, 133, 144 in.; floor space, 78, 97, 116 in. radius; weight without motors, 9,000, 12,000, 15,500 lb.; weight of motors and electrical equipment, 850, 1,000 and 1,200 lb.

bearing rollers on which the head is mounted are provided with eccentric shafts which permit adjustment for wear.

The spindle drive is from a vertical reversible motor mounted on the head which is direct-connected to the drive shaft by a self-aligning coupling. Conical friction-type clutch gears provide connection to the drive shaft, and four gears keyed to the clutch shaft drive the spindle sleeve through change gears on an auxiliary shaft. Sixteen spindle speeds, from 19 to 310 r.p.m., can be obtained by shifting levers, all of which are on the head.

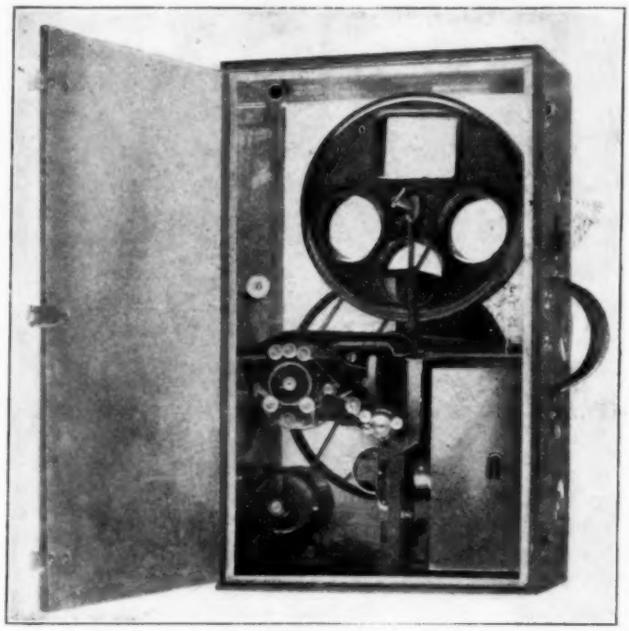
Two series of 8 feeds each are provided and these range from 0.005 to 0.078 in. and from 0.023 to 0.370 in. per revolution. All feeds are disengaged instantly by a friction clutch on the hand wheel shaft, and this may also be controlled by an adjustable stop which disengages the feed when the desired depth has been reached. For tapping, the motor is reversed, which can be accomplished instantaneously without shock on the transmission or wear on the friction clutches.

An independent motor is mounted on the top of the column for raising and lowering the arm, driving the elevating screw through a reducing gearing. Limit switches are provided which open the motor drive circuit and thus protect the machine.

The arm is attached to the column by a long sleeve and is mounted on ball-bearings. A pneumatic clamping device for the arm can be furnished if desired.

Portable Graphoscope Projector

A motion picture machine designed especially for the use of salesmen has been introduced by the Graphoscope Development Co., 50 East 42nd Street, New York



PORTABLE GRAPHOSCOPE PROJECTOR

City. The complete unit, ready to run, is contained in a case the size of an ordinary suit case. It has a motor drive and is simply constructed, as may be seen from the illustration and is said to be fireproof. It uses standard film and will project a good picture 10 ft. square, at a distance of 35 ft. For a quick demonstration, such as showing the operation of machinery, etc. in motion, the pictures may be projected on a blotting pad or other improvised screen placed at a distance of 2 or 3 ft. from the lens. A picture thus displayed shows clearly in subdued daylight without darkening the room. About 1,000 ft. of film will carry a very concise story to prospective customers.

Gammons Taper Pin Reamer

The spiral reamer shown is a product of the Gammons-Holman Co., Manchester, Conn. It is claimed that the spiral design permits holes to be reamed at any reasonable speed and feed with a minimum risk of breakage.

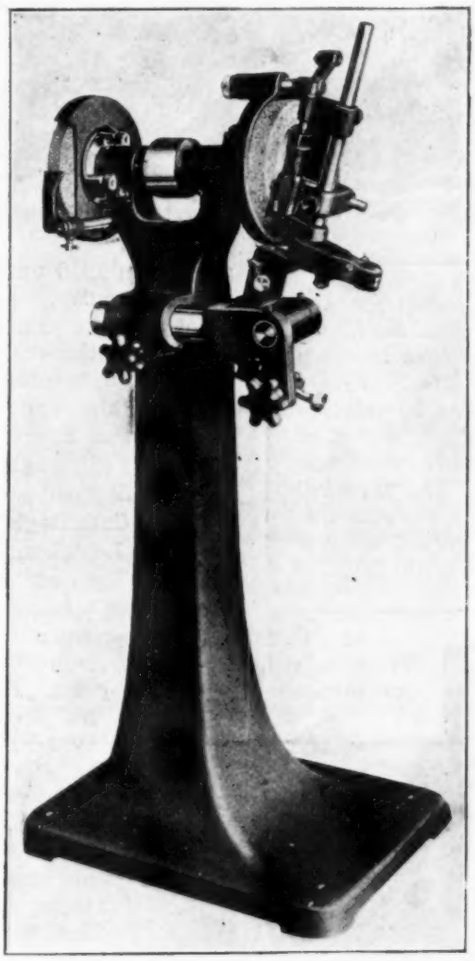
It cuts rapidly and freely; the chips resembling steel wool. It is intended for use in drilling machines, and in addition to reaming holes for taper pins is said to be useful in die making for removing the metal between holes that have been drilled close together. The reamer is made in all standard sizes for taper pins having ¼ in. taper to the foot, and can be furnished on order with special taper if required.

GAMMONS TAPER PIN REAMER

Grand Rapids Tap-Grinding Machine

The Grand Rapids Grinding Machine Co., Grand Rapids, Mich., has added to its line the tap-grinding machine illustrated herewith.

This machine is intended for grinding the taper at the end of a tap and the clearance back of the cutting edge thus formed. Any desired taper can be ground. The clearance produced is convex and eccentric.



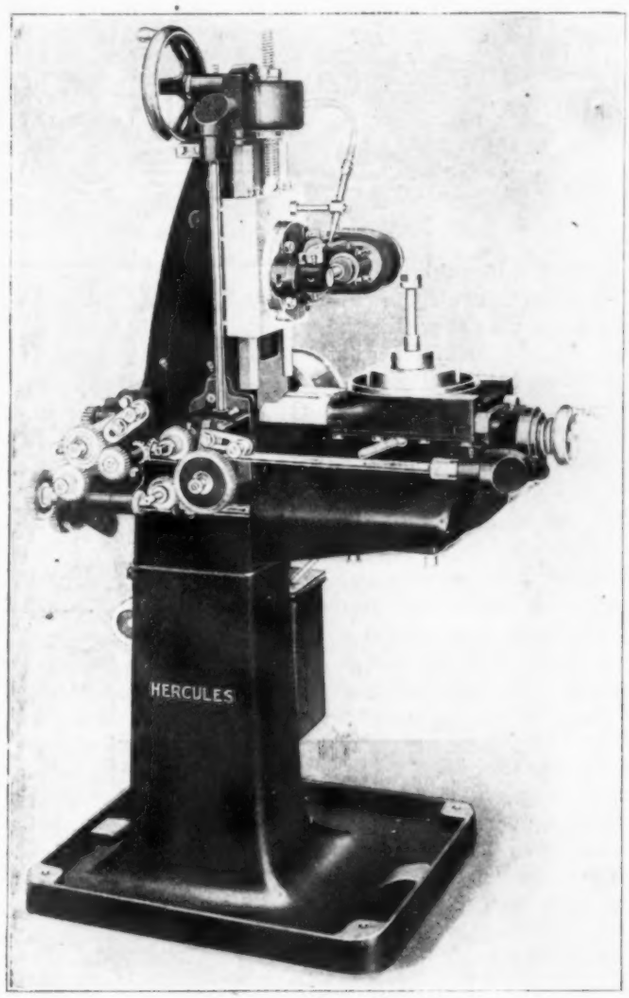
GRAND RAPIDS TAP-GRINDING MACHINE

In grinding, the tap is held between centers and swung into grinding position. An adjustable stop and an indexing finger provide means for grinding the same taper and clearance on each of the lands. Either right- or left-hand taps from ¾ to 3 in. diameter can be ground.

The regular equipment includes a truing device complete with diamond.

Hercules 8-In. Gear-Hobbing Machine

The Hercules Machine & Tool Co., Astoria, N. Y., with sales offices at 404 Broome St., New York City, has improved the design of its 8-in. gear-hobbing machine. A special device providing means for exact adjustment is now used for centering the hob. For generating spiral gears a differential is employed which simplifies adjustment and assures precise machine operation. Automatic stops are provided for disconnecting the feed when machining either spur, spiral or worm gears. An effective cutting lubricant supply system is furnished when required, which includes tank, pump, piping, etc., complete. A special arbor support designed to hold securely a gear blank with small bore is furnished as an extra. As may be seen from the illustration, this is held in a position that allows the chips to drop free from the cut.



HERCULES 8-IN. GEAR-HOBBING MACHINE

Specifications: Capacity, generating steel gears, 10 D.P.; outside diameter of largest gear cut, 8 in.; width, 6 in.; minimum distance from center of work arbor to center of hob mandrel, 3 in.; size of countershaft pulleys, 8 x 3 in.; speeds of countershaft, 180 and 360 r.p.m.; floor space of machine, 24 x 36 in.; net weight, 1,050 lb.; domestic shipping weight, 1,250 lb.; export shipping weight, 1,350 lb.

White Lines on Blueprints

BY D. C. HOWARD

It frequently is desirable on blueprints to have some lines, such as section designations, stand out from the others in point of whiteness in the finished blueprint.

To secure this result, and to do cross-hatching, etc., with very fine lines and still have strong white lines on the print, use vermilion moist color of any of the standard French or other makes.

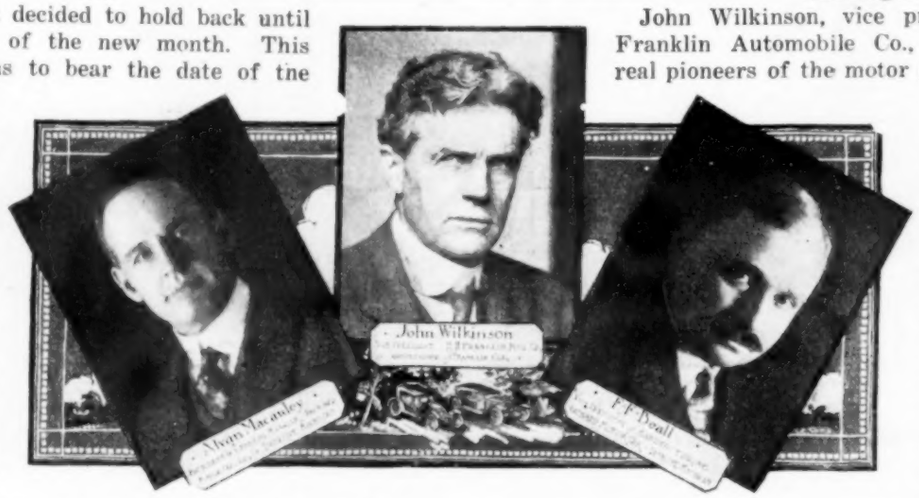
Mix the water color very thick and apply to the pen with a camel's-hair brush. The color will cake quickly in the pen and will necessitate frequent cleansing. However, the resulting white lines on the blueprint will be deeper and purer than can be obtained by the use of india ink.

WHAT to READ
—for the man in a hurry

Nobody who is holding down a man's job has time to read all of the American Machinist. On the other hand there are some articles in every number that you can't afford to miss. We are running this page to save your time by pointing out the articles in this issue that are aimed at men holding jobs like yours. Read the editorials —they are short and to the point. The "Sparks" will give you the latest news of the machine industry. The "Shop Equipment News" columns show the innovations in tools and methods.

A PAGE like this is such a departure for a conservative old paper like the *American Machinist* that we have hesitated a little about introducing it. Not that we haven't had special features to talk about; we have. Every issue of 1920 has had at least one.

We almost let it go last week to congratulate ourselves on the leading article, but decided to hold back until the first issue of the new month. This number happens to bear the date of tne Feast of All-Fools. We hope that there will be no significant connection between our innovation and the usual events associated with this joyful occasion.



In this issue and in several of the succeeding ones we have gathered together careful, detailed information on machine work in the shops of some of the best-known automobile manufacturers. We are limiting the discussion this week to cylinder operations and to make the material as useful as possible have put the methods used in five different plants under one head, with the idea that comparison will be easier that way.

This information is so timely that it has been given leading space. It was secured by Fred Colvin who has been devoting a good part of his time for the last six months to a study of the machine-shop end of the automobile industry. Unfortunately we couldn't get all the cylinder data into one issue. The rest of it has been printed in previous numbers.

To get some of the well-known "human interest" into this subject we have secured photographs of several of the big men of the companies represented by these articles. Here we have Alvan Macaulay, president of the Packard Motor Car Co. since 1916, and general manager from 1910 until now. Mr. Macaulay, general-managed the Burroughs Adding Machine Co. for ten years before the Packard got him and before that he was attorney and director of engineering and development for the National Cash Register Co. He is a Lehigh man and studied law at George Washington University.

John Wilkinson, vice president of the Franklin Automobile Co., is one of the real pioneers of the motor game. He built his first four-cylinder motor in 1898 and his first six in 1905. The Franklin people claim that these were both "firsts" in their field. In 1902 Mr. Wilkinson started his campaign for weight reduction by switching from water to air as a cooling medium. This change took nerve but the present standing of his company and its product vindicates him.

The other gentleman is F. F. Beall, vice president of manufacturing for Packard. He is both a practical and a technical man and has been with his company for more than ten years. Much of the excellent modern shop equipment in the Packard shops and many of the efficient manufacturing methods are due to his efforts.

The men from the other companies included in our series will get their turn later. Space prevents putting them all in at once as we would like.

We haven't much room left to talk about the other articles this week, but we want to call attention to Commander Gatewood's description of the Balboa pattern shop and Captain Henry's suggestions for standardizing the classification of grinding machines. The latter offers an excellent opportunity for come-backs and a chance to get your name in print, for there is still much to be said.

Commercial Aviation, Its Development Since the War and Its Scope in the Future

By F. HANDLEY PAGE

THE DEVELOPMENT of aviation, from primitive to modern times, the needs in this field today and the prospects of the future regarding the airplane as a commercial factor, were the salient features of a most interesting and instructive address, delivered last Tuesday evening by F. Handley Page, one of the world's foremost aëronautic engineers and constructor of the famous Handley-Page aëroplane. The occasion was a joint meeting of the Aëro Club of America and the New York Electrical Society. Mr. Page spoke in part as follows:

"There are three ways in which man can travel over the earth—by land, by sea and by air.

"The first development of the world's history in the primary geological formations was the development of sea travel by the lowest order of life, when the only living forms which existed were of the jellyfish variety.

"With the coming of the secondary geological formations, there appears on the earth those strange reptiles, of which remains have been found all over the world, and this development traveled by crawling all over the world.

Traveling on Foot

"When man first appeared in this world his means of progress were limited to the use of his arms and feet. His speed of travel for long periods was not more than 5 miles per hour, due to the fact that his weight per horsepower was high, being of the order of 1,500 lb. weight per horsepower. To improve this method of land travel, he trained mammals which were then on the earth, such as the horse, elephant, buffalo, etc., and combining his weight with theirs, attained a total less weight per horsepower than in the case of his own undivided effort.

"The invention of mechanical devices, such as the wheel-barrow by the Chinese, added to the facilities at man's disposal and increased the speeds to which he could attain.

"The ultimate development of natural land travel is seen in the development of the stage coach in the last century and the fast trotting sulkies that race today. You will notice in each case that high speeds are only attained where the weight per horsepower is reduced, and where this is made extremely small, carrying capacity is also practically reduced to nothing. Higher speeds than these were not attainable by an altered mechanical development. As you can readily realize, some inventor might have endeavored to place the horse inside the stage coach driving through a cog wheel mechanism, and by such a means endeavor to have obtained a bigger mechanical efficiency than by allowing the horse to run on the ground and both support its own weight and drag after it the vehicle to which it was attached. Such a development, as you can see, is quite an impossible one, and no further progress can be made until the prime mover driving the vehicle was reduced in weight and cubic feet capacity per horsepower.

"With the development in the last century of the steam and gasoline engine, a great progress was immediately made which you see perfected in the automobile and railroad engine. If you realize the small weight per horsepower and space occupied by the gasoline or steam engine, you can readily understand the basic reason for the increase in speed that has been obtained with these improvements.

"On the sea, developments proceeded on much the same lines. Man in his primitive state could swim—an art learned, no doubt, from imitation of the fishes—and later he was able to improve his speed by the use of boats carved out of the trunks of trees. The development of transport on the sea was a slow one and eventually the motive power of the wind was utilized and replaced multiplication of man power that was used in the old Roman galleys. Higher speeds were attained, owing to the reduction in the weight of horsepower that was obtained by the use of sails and the small amount of room which they occupied, compared with the necessary men that would otherwise have been required to row such a vessel.

"Sails had, however, their limit, the motive power was fickle and not to be relied on and the development of man power as a rower was impossible. As man develops an average of ½ hp. for continuous effort, it would require something like one quarter of a million men to develop the horsepower sufficient to drive the Mauretania across the Atlantic, a number of men which has only once been exceeded and carried in one ship. I refer to the crossing of those millions of people in the good ship Mayflower.

"Steam and the gasoline engine made high speed ocean travel possible, and were it not for ocean weather, further developments would be possible on the lines of the hydroplane and skimmer.

Problem of Aviation

"When, however, one turns to the problem of aviation and its use by man as the means of transport, one is confronted by the fact that it has never been possible to have birds large enough on whose back man might mount and learn to fly. In the secondary period of the world's geological formation, there existed great flying reptiles known as pterodactyls, and the development of the lizard into a large flying bat. These, although 30 or 40 ft. in span, did not exist concurrently with man and their influence on air transport was nil. Birds existed at the same time and we have the evidence of the remains of the Archeopteryx to show what they were like. They were a bird developed from a lizard and had a very large tail in comparison with the winged formation. It has always seemed to me that the early development of these birds was very much like airplane development in that they started with large tail area, which was progressively decreased as the development of the bird or machine was progressed.

In the great blank which separates the secondary from the tertiary period of geological formation, all these teeming masses of reptilian life disappeared, so that when we turn to the development of mammal life,

man had no means at hand to indicate how he could achieve successful flight.

"Let us briefly review then the stage to which mechanical transport had reached before the present flying era. Speed on the ground was about 100 miles per hour, although some special experimental trains were built and operated near Berlin about 15 years ago which attained a speed of 120 miles per hour. On the ocean, the fastest torpedo boats had reached speeds of between 40 and 50 miles per hour, and both these means of transport had reached the economical limits of weight per horsepower development, and for further progress, man had to turn to the new element, namely, the air, the invention of which had been made possible by the development of the gasoline motor.

"Aviation in the early days was a case of managing to keep off the earth at all cost but without any thought of efficiency. The weight per horsepower was in the neighborhood of 40 to 50 lb., the modern starting point of successful flights for the Wright Brothers in this country in 1903. Then followed the improvement of machines from an efficiency point of view, the stream lining of the body, the improvement of plane areas, the reduction in weight per horsepower of the motor, together with improved methods of carburetion. All these lessened the weight per horsepower of the air vehicle and permitted of the atainment of higher speeds. So from the old machines doing about 40 to 50 miles per hour with a weight per horsepower of 40 to 50 lb., we have progressed to the modern scout which only weighs 7 or 8 lb. per horsepower all told and has a top speed of 150 or 160 miles per hour in still air.

War Speeded Development

"The millions which have been spent in every country in air development have made this great progress possible and aircraft movement is exceedingly fortunate in that amidst the great suffering caused by the war, the aircraft industry has reached a point of development which it could not have attained by years of normal peaceful achievement.

"Of this development full advantage should be taken so that the investment so made is not lost. In this direction, with the coming of peace, we have devoted our energies in the research department to the perfecting of an airplane with less weight per horsepower but still a high speed of travel.

"The type of machine which we now have flying has a useful weight of 3,500 lb. apart from petrol and oil or crude, a speed of 115 miles per hour and a non-stop flying capacity of 500 to 600 miles. With the later improvements that we now see possible, we expect to reduce to 300 the horsepower required for this performance, with a corresponding decrease in cost of operation. The same advantage too can be gained in small machines and we can visualize a small machine of 25 horsepower capable of carrying pilot and passenger at a speed of 100 to 110 miles per hour for a non-stop distance of 400 to 500 miles. If we now look back along the whole long-drawn-out history of the world's economic development, can we not at this moment feel that we stand at a new point of development in the world's history and that the airplane, developed as it is today, improved still further as it will be tomorrow, points the finger-post along the line of commercial development and shows us the instrument at hand for future development?

"Of this development we, in England, have been able to take advantage and with the ground work available and large machines converted from war purposes to those of peace, it was easy to start services. The results have been very satisfactory.

"Although we have been operating only during the winter months, for flying outside England was not permitted before Sept. 1, 1919, we have flown no less than 82,428 miles, have carried 4,201 passengers and 49,457 lb. of freight without injury to a single passenger or loss of a pound of freight, a record which can surely challenge any other means of transportation. These records show what can be done even with a new improvised service organized quickly on the coming of peace.

"The influence of air transport is going to be enormous in the world's development. To a great country such as the United States of America, where towns are separated by great distances, the airplane will act like a gigantic hand and squeeze these towns and cities closer together. Distances are measured by mankind by the time which it takes to go from one place to another. The distance of 1,000 miles or so from New York to Chicago means nothing to the business man. He knows only of the 20 hours on the train. By air, in 7 or 8 hours, or less with a following wind, Chicago moves closer to New York and is no further away from the point of view of time in the air than Syracuse is on the railroad today.

"If I have spoken of the development only on the other side and left out the great flights which have been made here, such as the continual service between Washington and New York, the flights of Colonel Harts on the Martin Bomber around the Rim, Mr. Lawson's great flight on the Lawson air liner, Commander Reade's great work with the NC-4 as well as the work all over the country of Curtiss machines and many others—if I have not referred to these, it is only because I am a stranger to this country. I have touched more fully on the work done on the other side, because with it I am more acquainted."

Following the address, the flight of the giant Handley-Page airplane from London to Warsaw was shown in moving pictures. Mr. Page explained the features of the flight as the pictures appeared on the screen.

EMPLOYMENT—One day a stalwart Scandinavian appeared in the employment office looking for "vork." The agent had on his desk a requisition for more help in the press department, so after the few preliminary questions dear to the heart of an employment agent, he asked the Swede if he "ever worked on a press?"

"Yas," replied Eric, "I run plenty prass."

"What kind of press?"

"Plenty big prass," and here the applicant made motions with his hands to indicate that the presses with which he was familiar would occupy all the space in the room in which they stood. The agent was duly impressed with the magnitude of the machinery but wanted more specific information.

"Yes; but what *kind* of press was it? Was it a drawing press; a punch press; or a hydraulic press?" What did it make?"

"Cider," answered Eric.

He was not hired.

What Other Editors Think

Beware of the Metric System Propaganda

HENRY HARRISON LEWIS, EDITOR OF *Industry*

IT IS intimated that in the near future a bill will be introduced in the House of Representatives by a member of the Committee on Coinage, Weights and Measures to make the metric system compulsory in the United States after a certain period, possibly within five years. During the last two or three years there has been a persistent campaign going on in this country to induce Congress to change our system of weights and measures and substitute the metric system. This propaganda, in its present form, had its origin on the Pacific Coast, and it has spread widely and has been handled apparently very effectively. The result is to create what appears to be a demand for the metric system, whereas the situation really is that a limited number of persons are interested in it to such an extent that they are willing to finance a campaign of so-called education.

The manufacturers of the country are specifically concerned with any legislation which would impose upon them the metric system. Such a system would compel great changes in machinery, impose unnecessary expenses, and also make it necessary to educate their employees in the new system. The education of employees would not be an easy task, and, aside from the expense, there would be found in an excellently regulated shop a great deal of chaos and confusion. The British Parliament, at one time, considered the adoption of the metric system, under the pressure of propaganda such as we are experiencing now, and after full consideration and study rejected it as impracticable.

The arguments offered in favor of the metric system are that it is in universal use, except in the United States, the British Empire and Russia. That argument does not offset or minimize the difficulties of establishing the system in a country of 110,000,000 people educated in their own system, and perfectly satisfied with it. It is further argued that the adoption of the system is easy and the transition period short. That is a gratuitous statement, based on guess work and easily contradicted by testing the average school boy who has studied the metric system and finding out his ability to apply it in the ordinary daily intercourse of life.

It is also argued that the system leads to important saving of time in calculations. That may be true, if we assume a perfect knowledge of the metric system, but in the United States we should first have to instill in 110,000,000 people, who had no desire for the information, that perfect knowledge of the metric system. It will be admitted that this is difficult, if not impossible.

The chief argument is that the adoption of the system is important, in the interest of foreign trade. That argument does not stand up very well in the light of the enormous export business we are doing today and have done for years.

Speaking frankly of the proposal, it savors merely of an attempt on the part of some faddists to make a change in the ordinary and necessary methods of doing business in the country. Even if a period of five years is permitted for education, it cannot be assumed that each citizen is immediately going to familiarize himself with the metric system. No one will pay any attention to it until the day it goes into effect, and then there will be chaos and confusion.

The small trader, the small shopkeeper and the ordinary housewife will find themselves at daggers' points, and finally trading on the old basis, but with the suspicion engendered on the part of the housewife and fear for the loss of customers on the part of the storekeeper. Should this bill be introduced, the basic facts in the case should be made plain to the committee of Congress and to the members of Congress themselves.

The Aviation Service

FROM *Harvey's Weekly*

GLOSS over the matter as you will, the one outstanding fact concerning the aviation service is that for every American-made plane that reached the front we spent nearly five million dollars. That is to say, there were just 213 such planes, and our war aviation service cost us $1,051,000,000. A simple exercise in long division completes the story. It was natural and inevitable that we should have to pay the penalty of our neglect of preparation. It is true that we purchased thousands of planes and engines from other countries, and that we conducted extensive training schools for aviators. It is also true that we established plants which at the end of the war were producing at the rate of many thousands a year. But all these considerations cannot dispel the feeling that there was monstrous waste somewhere in the department directed by one of the ablest public servants the President has ever known.

There is, proverbially, no good in crying over spilled milk. But there is some good in penalizing anyone who caused the spilling through mischief or greed, and also, we should certainly say, in saving the pail for another milking. In other words, if some considerable part of that billion dollars was invested in plant and fields and training schools, that investment should not now be permitted to go to waste or to be neglected. We should have now a pretty complete and extensive aviation establishment, sufficient to afford a reasonable degree of preparedness for future needs. It would be sheer profligacy to let it fall into desuetude.

We should not, of course, keep on spending money at such a rate as during the war. But we should see to it that our aëronautical establishment is maintained comparably with our army and navy, both in size and in quality. That will mean much experimenting, since air navigation is still in the experimental stage. But we should do it. It would be a national disgrace for us to sit down in idleness, waiting for other nations to do the experimenting and to perfect the airplanes. We ourselves should take the lead in invention, as we have done in other directions.

SPARKS FROM THE WOR

Valentine Francis

New International Chamber of Commerce To Be Formally Organized

The new International Chamber of Commerce, projected at the International Trade Conference at Atlantic City last October, will be formally organized, it is announced by the Chamber of Commerce of the United States, at Paris during the week of June 21, 1920. Invitations have been sent out by the American group of the International Organization Committee to business and industrial associations, asking them to name delegates to participate in the organization meeting. About 100 American delegates are expected to attend.

The International Organization Committee, which was provided for at the International Trade Conference, is to meet at Paris in advance of the general organization meeting, which will be held in June, to prepare and report a plan of permanent organization, the basis of which was drafted and approved at the International Trade Conference. Plans will be presented by the Organization Committee for a strong and active International Chamber. Steps will be taken for the creation of a permanent international headquarters; officers will be elected and the work of the chamber will actually begin.

In view of the disturbed conditions in international trade brought about by the exchange situation this meeting is expected to assume considerable importance aside from the fact that the International Chamber is to be organized. The important question of international credit, as well as shipping, tariff regulations, unfair competition in international trade, and other problems of equal importance affecting stability in international trade and production in all the principal countries in the world, will be discussed.

American members of the Organization Committee whose names are now announced are:

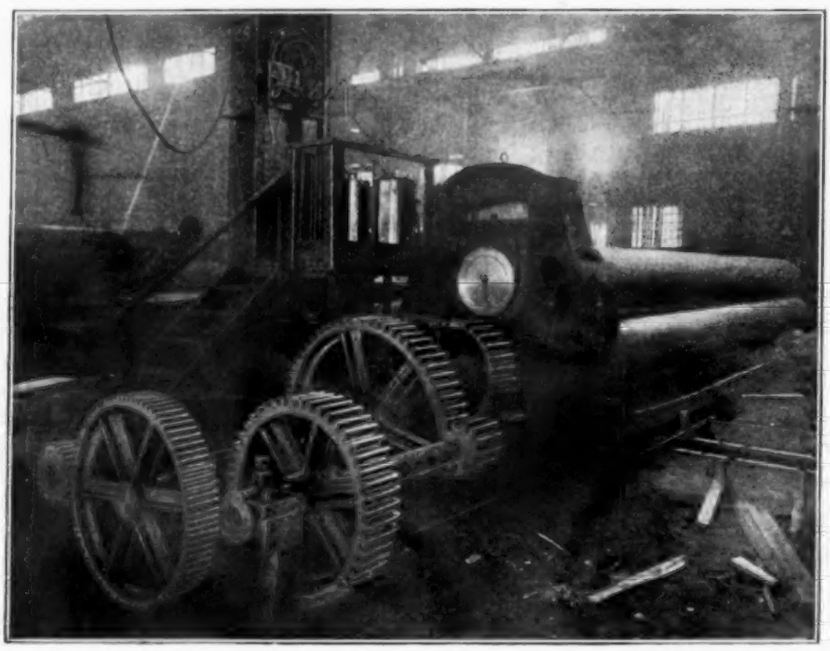
A. C. Bedford, chairman of the board of the Standard Oil Co., and member of the National Foreign Trade Council, New York, chairman.

Thomas W. Lamont, of J. P. Morgan & Co., New York City.

Edward A. Filene, president, William Filene's Sons Co., Boston.

Richard S. Hawes, president of the American Bankers' Association, St. Louis.

John H. Fahey, of Boston, formerly president of the Chamber of Commerce of the United States.



IMMENSE PLATE BENDING ROLL

These large rolls have a total weight of 160 tons—the top roll measuring 30 in. in diameter, 35 ft. 6 in. in length and weighing about 45 tons. The two bottom rolls each have a diameter of 20 in., are 35 ft. 6 in. in length and weigh about 22 tons each. This machine measures 35 ft. 6 in. between housings with a capacity to bend 3-in. mild steel plates. The high speed and roll bearings are bronze bushed; all other bearings are babbitted. These rolls were purchased from the Southwark Foundry and Machine Co., Philadelphia, by the Petroleum Iron Works Co., Sharon, Pa.

S. C. Mead, secretary of the Merchants' Association of New York, vice chairman and secretary.

The foreign members of the committee, as just cabled to this country, are:

BELGIUM

Louis Canon-Legrand, chairman, president of the Chamber of Commerce; consulting engineer, Mons, Belgium.

Prof. Paul Van den Ven, University of Louvain. Delegate of Belgian Minister of Finance at Paris, Brussels, Belgium.

Alexander De Groote, vice president, Antwerp Chamber of Commerce, Antwerp, Belgium.

Two additional members of this committee will be named by the Central Committee of Industry of Belgium.

FRANCE

M. Eugene Schneider, chairman, head of Creusot Steel Works; president, British Iron and Steel Institute; former member of Chamber of Deputies, Paris, France.

M. Tirman, Councilor of State, Paris, France.

M. Roche, delegate of General Syndicate of Chemical Products, and Administrator Delegate of the firm of Poulenc Brothers, Paris, France.

GREAT BRITAIN

Lord Desborough, chairman, president, president of the British Imperial Council of Commerce, and formerly president, London Chamber of Commerce, London, England.

Sir Arthur Shirley Benn, K. B. E.; M. P., managing director, Hunter, Benn & Co., London, England.

Edward Manville, president, Association of British Chambers of Commerce; vice president, Federation of British Industries, Coventry, England.

Stanley Machin, president, London Chamber of Commerce, London, England.

One member of the committee will be named to represent the banking interests of Great Britain.

R. B. Dunwoody, secretary, Association of British Chambers of Commerce, London, England.

ITALY

Comm. Ferdinando Quartieri, chairman, president of the Italian Corporation for Chemical Industries, Milan, Italy.

Comm. Prof. Vittorio Meneghelli, president, Chamber of Commerce of Venice, Italy.

Comm. Giorgio Mylius, president of the Italian Master Cotton Spinners' and Weavers' Association, Milan, Italy.

Comm. Pietro Giovanni Lazzerini, Lazzerini Brothers, Shipping, Carrara, Italy.

Comm. Augusto Jaccarino, Banco di Napoli, Rome, Italy.

The International Chamber succeeds the old International Congress of Chambers of Commerce which ceased to function with the outbreak of the World War in 1914.

The specific aims of the organization as outlined by the Committee on Organization are:

To create a permanent international headquarters to centralize all data concerning economic subjects and social conditions, the facts relating to the respective needs, present production and future possibilities of each country.

To act as an instrument of coordination which will suggest trade regulations and legislative measures to facilitate and encourage the development of economic commerce.

To inform public opinion through the publication of facts with regard to

LD'S INDUSTRIAL FORGE
News Editor

business conditions and through the dissemination of views of technical experts and business men.

To put at the disposal of all official organizations the reports and conclusions prepared by these experts and business men.

The Committee on Permanent Organization of the International Trade Conference agreed tentatively that the constitution of the new chamber should provide, among other things, for:

A board of directors composed of two members selected by each nation.

An international headquarters, with one representative of each nation attached to it, assisted by technical experts; all to be under direction of a general secretary.

A corresponding bureau in each country.

Membership to consist of chambers of commerce, commercial organizations, banking and similar associations, firms, corporations and individuals, holding associate but not voting membership.

Meetings of the membership every two years.

A system of referenda to be issued during the interval between the bi-ennial meetings of the members.

Other objects of the association are:

To make import and export trade easier.

To remove international friction, much of which begins with commercial differences

To safeguard international trade against waste and fraud.

To increase the total production of the world, and make the product available to the people of the world.

To standardize international documents, practices and laws affecting commercial intercourse.

To increase mutual profitableness of international transactions.

To cultivate personal acquaintanceship among business men and bankers of the different nations of the world, and thus lessen misunderstandings.

At the first meeting in June only the five countries participating in the International Trade Conference, the United States, Belgium, Great Britain, France and Italy, will be represented.

Employees' Reading Room

The Laidlaw Works of the Worthington Pump Corporation, Cincinnati, Ohio, has innovated many things for the welfare of its employees, among which may be commended is the reading room shown in the accompanying illustration. The room has been plainly furnished and is open for the use of employees from 12 o'clock to 12:40 daily, being in charge of a librarian at this time.

Current issues of all the well-known technical magazines are kept, which are supplied to any employee interested.

THE LAIDLAW WORKS' READING ROOM

Any magazine may be taken home by permission of the librarian, but must be returned within a reasonable time. Such books as the "American Machinist Handbook" may be either bought or borrowed by the employees. In order to keep alive the interest in the reading room the company's paper devotes a page of short articles each month under the title "Reading Room Notes." This scheme has worked successfully, as many suggestions have been made by readers through these columns which have been carried out to the benefit of the reading room.

The popularity of the reading room may be judged from the fact that many employees eat their lunches there so that they may have an opportunity to peruse their favorite technical magazines and incidentally profit by the knowledge that they gain.

Trade Currents from New York, Cleveland and Chicago

NEW YORK LETTER

With March business virtually all in, the volume of business handled by the local machine-tool houses compares favorably with the corresponding periods of any previous year. In many lines, the month just closed returned high-peak results.

Large lists are more frequent of late. The General Electric has a substantial list out for its Bridgeport plant. The Lehigh Valley sent out a list of twenty-six tools with numerous attachments. The B. & O. will issue a large list within two weeks.

The Otis Elevator Co. has practically completed purchases on its most recent lists. The S. S. White Dental Supply Co. was a buyer last week, and the Edison Lamp Co. is reported out of the market with the completion of a recent list. The American Locomotive Co. is said to be in the market for hand screw machines.

The incorporation list for the past week includes the Brooks-Steel Corporation, manufacturer of motor wheels, with R. L. Wood of 1221 Bedford Ave., Brooklyn, receiving inquiries. Capitalization, $531,000.

The National Electric Water Heater Corporation, with $2,000,000 capitalization, is represented by Robert R. Vanvooris, Jersey City, and Cornelius A. Cole, Hackensack. It will manufacture a general line of electric water heaters.

The Haverford Cycle Co. has increased its capital stock from $350,000 to $500,000 to take care of coming increases in production, and the General Insulate Co., of Brooklyn, gives a like reason for an increase of $200,000 on its original $50,000 capitalization.

The delivery situation is still unchanged, and, due to the coastwise stevedores' strike, water shipments of machine tools have been greatly impaired. No improvement in the rail transportation outlook is noted, and the delay in delivering machine tools both to branch houses and to customers is giving the factories no little concern.

Cleveland Letter

Some recovery in the machine-tool demand in the Cleveland and northern Ohio territory is noted in the past week. While many of the bigger interests, including automobile and parts builders, still show a disposition to hold out, there has been a decided increase in inquiries and orders from among the smaller manufacturers.

Machinery manufacturers and distributors point out that it is difficult to meet the demand for immediate delivery. This is bringing in considerable inquiries for used equipment, but few establishments can offer a good selection of used equipment at this time.

That the more distant months of this year will be productive of bigger business in at least one direction is indicated by the tentative plans of rubber companies in the Akron section of this territory, which indicate that they are preparing to increase their production, and this is further substantiated by tentative inquiries along certain specialty lines.

One of the newest firms to open up possibilities for additional machinery demand in this section is the Freeman Motor Co., which has established temporary quarters in Whitney Power Block, Power Ave. and East 12th St. The company proposes to manufacture 500 trucks and twenty-five passenger automobiles during the present year. A feature of its production will be a four-wheel driving device for trucks. The device is the invention of F. L. Freeman, one of the incorporators. J. H. Albrecht is chief engineer. Other officers of the company are: M. O. Stonebreaker, president; Paul Reiff, vice president; George H. Reiff, secretary-treasurer.

Extent of the activities of the Fisher Body Corporation for its activities here is recognized in the plan for its new factory at East 140th St. and Coit Road. Here a six-story structure, occupying a tract of 613,000 sq.ft., and containing 1,600,000 sq.ft. of operating space, will be built. The New York Central Railroad tracks will run through the building, which will cost about $6,000,000, and which is said to be the largest single manufacturing unit in the country.

Chicago Letter

Quiet prevails in the machinery trade in this district. The recession in volume of new business, which was noted last week, has become more pronounced. Not only is the amount of actual business being booked undergoing shrinkage, but a decided falling off is noted in inquiries received. The most important single factor evident is the complete withdrawal of the automobile industry from the buying market.

Very circumstantial reports are to the effect that the auto builders of the Detroit district have practically cut their 1920 output schedule in half. They are said to have been governed by four considerations: Difficulty in securing raw material, difficulty in securing labor to operate on a high-production basis, danger of overproduction toward the end of the year, and a desire to avoid making too much profit in 1920 in view of the uncertainty of future tax requirements. It is probable that the overproduction feature is the determining consideration as, had their original schedules been adhered to, there would at the close of the year have been an automobile in existence for every twelve people in the country.

Present plans seem to be to finish the year with the equipment so far ordered, but to proceed no further with plant extensions. Tractor builders, particularly those controlled by automobile makers, seem to be following the same idea. No new orders or inquiries are being received from the tractor interests and one concern is said to be negotiating for the cancellation of orders for certain equipment.

The thing which all dealers are awaiting with interest is the entrance of the railroads into the buying field. Nothing has yet appeared to indicate to what extent railroad buying will develop. An inquiry for six tools for the Chicago Junction Ry. is the only rail activity that has been noted. Similarly, machinery orders from makers of railway appliances and equipment are dependent on orders from the various roads.

Aside from the foregoing, no particular activity or lack of such has been felt in any certain industry. Such orders as are still coming are widely diversified, both as to class of material and as to origin. Large plant extensions announced by the Western Electric Co. foretell considerable business from that source.

Decision by a large tractor concern to equip each of its service stations with a uniform type lathe shows possibilities for sales in that direction.

It is not to be assumed that business in the Chicago district is poor, or is going to be poor. Far from it. Back orders exist in sufficient quantity to insure prosperity for some time to come, and deliveries are still fearfully slow. Furthermore, a reduction of the recent heavy buying pressure will give small machinery users a chance to have their needs supplied.

What One School Gained by the Caldwell Bill

To the Editor:

The Tamalpais Vocational School of Mill Valley and Sausalito, Cal., announces that it has purchased the following machine tools foom the Government at fifteen cents on the dollar: One planer, seven engine lathes, two hand screw machines, two bench drills, one back-geared drilling machine, one universal toolroom grinding machine, one wet tool grinding machine, one cut off saw, one hand milling machine, one combination drilling and milling machine and one cylindrical grinding machine.

These, in addition to the school's present equipment of one universal milling machine, three engine lathes, three bench engine lathes, one speed lathe, one shaper, two drilling machines, one cut off saw, one arbor press, will enable it to do all kinds of machine construction and tool making.

The management of the school, considering this the chance of a lifetime, sent W. T. Elzinga, vice principal and machinist in charge under the Smith-Hughes Act, on a flying trip to Chicago and Detroit to purchase these machines several days before other school representatives could arrive on the ground.

The faculty of "Tamalpais" thanks the *American Machinist* for its splendid support of the Caldwell Bill.

E. E. Wood, Principal, and Wm. T. Elzinga.

An Immigration Conference

A national immigration conference will be held April 7 in New York City in the Engineering Societies Building, 29 West Thirty-ninth St.

National leaders in American industry and finance will discuss the shortage of foreign-born labor and the loss of production due to unrest among the workers, and measures will be taken for united action to relieve this condition.

Invitations to attend this conference have been issued by the Inter-racial Council to more than a thousand of the directors of industrial concerns, especially those employing foreign-born labor, and to others who are interested in this problem from the standpoint of finance on national welfare.

Topics to be discussed will include pending bills on immigration, and a constructive policy will be voted upon.

All industrial executives are invited to be present.

Further details may be secured by addressing Coleman du Pont, Chairman of the Board, the Inter-racial Council, 120 Broadway, New York City.

A bill has been introduced in the Maryland Legislature which is designed to authorize the State Industrial Accident Commission to make as many inspections of machinery as it deems necessary.

Engineering Division Has a New Test Furnace

The Material Section, Engineering Division, is supervising a test of the Government furnace at Shelby, Ohio. This furnace was installed during the war for the purpose of heat-treating steel tubing in quantities for airplane construction, but was not completed until very recently. It is now completed and undergoing a series of tests to determine the feasibility of producing heat-treated steel seamless tubing of very high tensile strength and elastic limit, to particularly meet Air Service Specification Number 10,229, for axle tubing.

The furnace, located at the plant of the Ohio Seamless Tube Co., is 7 ft. in diameter and 22 ft. deep, electrically heated and automatically controlled so as to give constant temperature within very narrow limits. The tubing is lowered into the furnace, which is sunken so that the top of the furnace is level with the floor, in a steel container (capacity 1,152 ft. of 2-in. tubing) by means of a crane. On reaching the required heat the container with its cargo is hoisted out of the furnace, transported over the quenching tank, where the bottom of the container is opened and the steel tubing, at the quenching temperature, is allowed to drop into the oil quenching bath.

The tempering operation is conducted in a similar manner, except that the maximum temperature of the tubing in the furnace is, of course, lower than it was for the quenching operation. These tempers run approximately 1,400 to 1,600 deg. F. for the quenching operation and 400 to 1,000 deg. for the tempering operation, depending on the quality of steel used and the physical characteristics desired.

This furnace will be used principally for the heat-treating of alloy steel tubing with special reference to the tubing used in axles. Up to the present time no axle tubing has been produced in quantities which will meet the requirements of Specification No. 10,229 calling for a tensile strength of 200,000 lb. with a 5 per cent elongation in 2 inches.

The Material Handling Machinery Manufacturers' Resolution

The following resolution was passed at the Convention of the Material Handling Machinery Manufacturers' Association, held at the Waldorf-Astoria Hotel, New York, N. Y., Feb. 26-27, 1920:

Whereas, That the expanding commerce and industry of the United States demand that support to the industry of the United States by the Government should be continued through the instrumentality of the Bureau of Foreign and Domestic Commerce; be it

Resolved, That the Material Handling Machinery Manufacturers' Association hereby urges the Congress of the United States to appropriate the sum of $1,900 000 as originally applied for by the Department of Commerce, for this service to industry; and be it further

Resolved, That a copy of this resolution be sent to the following:

The United States Senate, the House of Representatives, daily, technical, and trade papers.

A New Milwaukee Drop Forge Company

The Interstate Drop Forge Co., of Milwaukee, Wis., has been organized by a number of prominent Milwaukee and Chicago business men to manufacture commercial drop forgings for the automotive and machinery industries.

A 9-acre tract close to the A. O. Smith plant has been obtained and building operations will be started immediately. The Northwestern Bridge & Iron Co., of Milwaukee, has obtained the contract for the forge plant and machine shop.

The president of the new company is William C. Frye, who is also president of the Chain Belt Co. and secretary of the Sivyer Steel Casting Co. Major S. M. McFedries is vice president and general manager. C. R. Messinger is the treasurer; he is also connected with the Chain Belt Co. and the Sivyer Casting Co.

New Name in Oxy-Acetylene Field

The Oxweld Acetylene Co., Newark, N. J., and Chicago, has recently extended its manufacture of oxy-acetylene apparatus and equipment to include "Eveready" welding and cutting outfits.

"Eveready" is a new name in the oxy-acetylene field, but the apparatus is not new, excepting for certain refinements of design, having been used extensively in the metal-working trades for several years under the name of "Prest-O-Lite" apparatus.

The new name was adopted by the Oxweld company to suggest the ready convenience, adaptability and general-purpose uses of the equipment. The apparatus is designed to be used exclusively with compressed acetylene in cylinders, thus providing the welder and cutter a compact and complete portable outfit.

Trade Marks in Peru

Trade Commissioner Carlton Jackson, at Lima, Peru, again calls the attention of American manufacturers to the necessity of registering the trade marks of their products sold directly or indirectly in the Peruvian market.

It is pointed out by Trade Commissioner Jackson that while the Peruvian officials are disposed to protect the rightful owners of the trade marks, they have not always succeeded in preventing the pirating of American trade marks, and it is therefore urged that American manufacturers adopt the only safe course of having the marks registered in their own names.

Meeting of Milwaukee Engineers' Society

At the regular monthly meeting of the Engineers' Society of Milwaukee held on March 17, 1920, the speaker was Percy Day, manager of the gear department of the Falk Co., Milwaukee, Wis. Mr. Day gave an illustrated talk on "Falk Gears as Applied to Mine and General Uses." The talk described some of the work of the past few years of the Falk company during which it designed and manufactured some of the largest reduction gears ever made.

American Locomotive Co. Books More Engine Orders

Further orders for a total of 51 locomotives are reported by the American Locomotive Co. The Atlantic Coast Line has ordered 25 engines, to weigh 138 tons each; the Cuba Railroad ordered ten 87-ton engines; the Maine Central, four 103-ton locomotives and four 83-ton locomotives; the Katanga Railroad (Africa), four 50-ton engines; the Koppers Co. has taken two 50-ton engines; the Donner Steel Co. one 72-ton engine, and the Pittsburgh Limestone Co., one 20-ton engine.

Extension of National Screw Thread Commission

Without objection or discussion the bill providing for the extension of the term of office of the National Screw Thread Commission until March 21, 1922, was approved by the Senate on March 17. The bill was passed by the House of Representatives on March 1. If the bill had not been passed the Commission would have expired by limitation of law March 20.

American Society Safety Engineers' Monthly Meeting

At a regular meeting of the American Society of Safety Engineers, held March 19, in the Engineering Societies Building, New York City, safety features of engineering as related to elevators were discussed in detail. Several papers, presented by experts dealing with the cause and prevention of elevator accidents, contained much valuable statistical data relative to the subject. George B. Muldar, secretary, announced the admittance of fifty-two new members since the last meeting.

Charleston Navy Yard Has Floating Machine Shop

The Charleston Navy Yard, Charleston, S. C., has recently added a floating machine shop to its repair facilities. Heretofore vessels making into harbor for repairs had to be visited by the mechanics with tools and machinery, but under the new system vessels may lay in the lower harbor and the machine can be transported there to carry on the necessary work. The mobility of the shop is its chief feature, and it will save a great deal of time.

Obituary

ROBERT ARMSTRONG, president of Robert Armstrong & Brother, one of the largest companies in the South dealing in iron and heavy machinery, died at his home in Atlanta, Friday, March 12, at the age of sixty-five years. Mr. Armstrong was the founder of the company which bore his name, establishing the business in 1886. He was prominent in fraternal and commercial circles, and a member of the Yaarab Temple of the Shriners.

JOHN H. BENNETT, founder and proprietor of the Bay State Stamping Co., Worcester, Mass., died Sunday, Feb. 22, 1920.

ANTOINE T. LANGELIER, treasurer of the Langelier Manufacturing Co., Arlington, Cranston, R. I., died Monday, March 1.

MELVIN B. NEWCOMB, aged thirty-one years, chief engineer of the rubber machinery department of the Wellman-Seaver-Morgan Co., died on March 13, after a short illness, at his home, 742 West Ave., Akron, Ohio.

Business Items

The merger of the Meldrum-Semon-Greiner Co. and the Lowry-Knise Tool Co., making one of the largest and best equipped shops of its kind in Central New York, has been completed. The new company will be known as the Meldrum-Semon-Greiner Co., Inc., and its address will be Syracuse, N. Y. It will manufacture tools and special machinery, beside manufacturing snap gages in a separate shop.

The Admiral Anchor Co., Penn Seaboard Steel Corporation and the Tacony Steel Co. will have a booth at the National Marine Exposition, Grand Central Palace, New York, April 12-17.

Announcement has been made of a new selling arrangement by which Joseph T. Ryerson & Son, Chicago, Ill., will handle the sale of the hydraulic machinery products of the Camden Iron Works, Camden, N. J.

The Black & Decker Manufacturing Co., Towson Heights, Baltimore, Md., announces the establishment of a permanent office and showroom at 1436 South Michigan Ave., Chicago, Ill. This office will be in charge of R. G. Ames, whose territory has been extended to cover the Middle West.

The Cincinnati Grinder Co. is planning a two-story addition in the rear of its plant, 3233 Colerain Ave., Camp Washington, the dimensions being 107 x 60 ft.

The Duff Jack Sales Co., Ltd., located in the Oxford Circus House, 245 Oxford St., London, W. I., England, has been formed to represent the Duff Manufacturing Co. of Pittsburgh in the British Isles, and has been given the exclusive agency in this territory for Duff and Barrett jacks.

The Sullivan Machinery Co., Chicago, Ill., announces the following appointments by the Board of Directors: Arthur E. Blackwood, formerly manager at New York City, to be vice president in charge of finance and accounting; Howard T. Walsh, vice president, in charge of sales; Gilbert K. Wilson, assistant secretary, in charge of cost accounting; Nathaniel H. Blatchford, Jr., assistant treasurer; Emil A. Krevis, general auditor; Frederick W. Copeland, manager of foreign sales.

The Graton & Knight Manufacturing Co., Worcester, Mass., recently conducted six conventions for its salesmen and dealers at Philadelphia, Atlanta, New Orleans, Cincinnati, Chicago and Worcester. Scientific power transmission and the selling of leather belting were placed on record.

The Lafayette Tool and Equipment Co., Philadelphia, Pa., manufacturers of precision tools, has elected the following officers: William M. Marion, president; Joseph M. Stryhal, vice president; Dudley Shoemaker, secretary and treasurer.

The Rickert-Shafer Co., Erie, Pa., manufacturer of the Boehm die head and a line of tapping machines, announces the following appointments in its lineup: Secretary and general manager, A. A. Shafer; general sales manager, C. W. Howard, formerly with the General Electric Co.; general superintendent, A. J. Patterson, formerly with the Crucible Steel Co.; production manager, George Patterson.

A syndicate of Atlanta and Chattanooga business men has purchased the Southern Machine Works plant and properties at Chattanooga from the United States Government, and will operate the plant under its old basis.

Charles M. Manly and C. B. Veal have announced that they established offices at 250 West 54th St., New York City, as industrial engineers, specializing in the co-ordination of engineering and manufacturing requirements in the design, production and operation of automotive power plants and vehicles.

The Thomas Spacing Machine Co., Pittsburgh, Pa., has opened an office in Philadelphia. G. L. Bohannon will be in charge. The company manufactures spacing tables, multiple punches, punches, shears, angle bending rolls, angle planers, etc.

The A. G. Clarke Manufacturing Co., Kirkwood, Ga., is seeking a new location for its machine shop and foundry, being forced to leave Kirkwood owing to the objection of nearby residents.

The Rome Wire Co., Rome, N. Y., has recently authorized an increase in capital stock to $4,000,000, 7 per cent first preferred and $5,650,000 common, the shares both being $100 par value. The company's main plant is at Rome, comprising 22 acres, while the Buffalo plant comprises 11 acres.

Personals

W. S. RUGG, manager of the railway and marine departments, and Charles Robbins, assistant sales manager, both of the Westinghouse Electric and Manufacturing Co., have been appointed to the positions of assistants to the vice president.

ROBERT H. IRONS, president of the Central Iron and Steel Co., was recently elected president of the Association of American Steel Manufacturers at its twenty-fifth anniversary meeting, which was held in Pittsburgh, Pa.

CHESTER BERT LETTE, until recently connected with the New York Machinery Exchange, is now representing the Wickes Machinery Co., and Bertolette Machinery Co., of Jersey City, in Cincinnati, Ohio. He has taken offices in the Lincoln Inn Court Building.

WILLIAM R. GUMMERE, who for a number of years, represented the Independent Pneumatic Tool Co., in Cleveland, Ohio, has again become affiliated with that company. Mr. Gummere will be connected with the Pittsburgh branch, which is under the management of Harry F. Finney.

Y. NAKASANO, connected with the Japan Steel Co., has recently arrived from Tokio. Mr. Nakasano has visited the steel mills in the Pittsburgh district and is now studying ore methods at Standish, N. Y., and will be in the states for one year.

E. R. WOOD has joined the sales force of the firm of Alfred Herbert, Ltd., 54 Dey St., New York City, and will represent this firm in the New York district in the sale of its imported and domestic machine tools and supplies. Mr. Wood was formerly connected with the selling organization of Sherritt & Stoer, of Philadelphia, Pa.

F. J. MAWBY, for a number of years connected with the sales organization of Manning, Maxwell & Moore, Inc., and located at the New York office of this firm, has resigned this position and is now a member of the sales organization of the Cincinnati Co. and the Cincinnati Gear Cutting Co., of Cincinnati, Ohio.

MYLES B. LAMBERT, for many years actively connected with the work of the Westinghouse Electric and Manufacturing Co., was recently appointed manager of the railway department of the company.

HARRY W. RUPPLE of the Cleveland Automatic Machine Co. has returned from a survey of the machine-tool situation in Europe in the interests of his concern, and will shortly leave for the Pacific Coast on a similar mission.

J. E. OTTERSON has been appointed president of the Winchester Repeating Arms Co., New Haven, Conn., succeeding Thomas G. Bennett.

Catalogs Wanted

Miles C. Smith, Rochester, N. Y., wants to be put on the mailing lists of manufacturers of conveying machinery, mine and foundry equipment to receive their literature and other information.

The Cincinnati Automatic Machine Co., manufacturer of automatic screw machines, Oakley, Cincinnati, Ohio, would like to receive catalogs for its files from various manufacturers of machine tools.

Trade Catalogs

Tool Grinding Block. C. W. Brooks, 1052 State St., Springfield, Mass. A small folder describing and illustrating the tool grinding block

Gisholt Machines. Gisholt Machine Co., Madison, Wis. Folder, 8½ x 11 in.; illustrates and describes the Gisholt turret lathes.

Leather Belting. Hide Leather Belting Co., Indianapolis, Ind. Bulletin, pp. 15, 4 x 9 in. A bulletin describing and illustrating the process of leather belting used by this company.

Electric Furnace. Electric Furnace Co., Alliance, Ohio. Booklet No. 8 B, pp. 15, 8½ x 11 in. This booklet gives some installations of Baily electric furnaces for melting non-ferrous metals.

Chucks. Smalley General Co., Inc., Bay City, Mich. Circular, 8½ x 11 in. A double-page folder giving data of its different methods of chucking and chucks used on the Smalley general thread miller.

Gage Blocks. Wilton Tool and Manufacturing Co., Boston, Mass. Catalog No. 24, pp. 16, 8 x 10½ in. An illustrated and descriptive catalog of the Wilton master gage blocks, its prices are also given.

Holders, etc. Interchangeable Counterbore Co., Detroit, Mich. Catalog, pp. 15, 8½ x 11 in. This catalog illustrates and describes its various products such as core drills, holders, counterbore cutter, etc. List prices are also given.

A Message of Measurements. The Wilton Tool and Manufacturing Co., Boston, Mass. Booklet, 3 x 6 in. This small booklet is a treatise on the use and care of precision gage blocks; it gives tables of the coefficients of expansion of various substances and the surface tension of liquids.

Gear Chucks. Garrison Machine Works, Dayton, Ohio. Catalog, pp. 16, 6¼ x 9½ in. This catalog describes the design and workmanship of its gear chucks also the operation. There are four line cuts and two halftones illustrating the construction of the gear chucks manufactured by this company.

Marking Devices. Pittsburgh Steel Stamp Co., Pittsburgh, Pa. Catalog No. 54, pp. 29, 6 x 9 in. This catalog contains illustrations and descriptive matter of its steel stamps for various purposes; also shows a few uncolored illustrations of its engraving department, grinding department and machine room.

Chain Gearing. The Association of British Driving Chain Manufacturers, London, England, has issued a short pamphlet of notes on chain gearing and its application. For further particulars relative to chain strength, rivet-wearing areas, weights per foot and prices, reference should be made to the current lists, published by the individual members.

Baird Tools. Baird Pneumatic Tool Co., Kansas City, Mo. Catalog No. 9, pp. 38, 10¼ x 7½ in. This catalog describes and illustrates the various tools which are manufactured by this company, such as cutters, riveters, rivet furnace, vacuum burners, etc.; specifications also included. The two last pages are devoted to the care of pneumatic machines and a list of some of the users of Baird tools.

Twist Drills, Reamers, Chucks, Milling Cutters, Taps, Dies, etc. Catalog, pp. 446, 4¾ x 7½ in. The Morse Twist Drill and Machine Co., of Worcester, Mass., has issued a 1920 catalog containing a full description of the tools it manufactures, together with much useful information in regard to them. Some space is devoted to grinding drills properly, in which some of the gages are shown. Various tables of speeds, feeds and decimal equivalents of drills are included.

Steam Tables for Condenser Work. The Wheeler Condenser and Engineering Co., of Carteret, N. J., has issued a small 7 x 4 in. handbook of steam tables, with pressures below atmosphere expressed in inches of mercury referred to a 30 ft. barometer; also including a discussion of the use of the mercury column, the errors in such measurements and constants for their correction.

New Publications

The Mechanical World Year Book For 1920. Emmot & Co., Ltd., Publishers of *Mechanical World*, Manchester, England. 645 4 x 6 pages, bound in cloth; price 2 shillings net.

This is a valuable reference book for the Mechanical Engineer. Three hundred and twenty-five pages are devoted to information on steam engines and boilers; gas and oil engines; gas producers; air compressors; hydraulic machinery; rope and belt power transmission; conveyers; gearing; properties of metals; notes on steel treating; strength of beams and structural shapes; and kindred subjects of interest to the shop man, including conversion tables, trigonometric functions, logarithms, etc. The remaining pages are divided about equally between advertising matter and a buyer's guide, the latter printed in French, Russian and Spanish. There are also conversion tables of money and of weights and measures used in various countries.

Little Known Facts About Grinding. By Howard W. Dunbar. 174 pages, 5 x 7 in., illustrated, neat cloth-board covers. Published by the Norton Company Worcester, Mass.

This book contains a series of brief articles, treating of commonplace facts concerning grinding; it has been reprinted from "Grits and Grinds." The easiest way to judge quickly the information this book contains is to scan the following list of headings: Belting, Truing the Wheel, Lubricant, Wheel Spindles, Cam Checking, Centers, Wheel Action, Surface Grinding, Wheel Grades, Dont's, Form Grinding, Wheel Spades, Chatter Marks, Traveling Wheel or Traveling Heads, Cam Grinding, Does the Grinding Wheel Actually Grind? Grain Size and Its Effect on Finish, Wheel Dressing and Truing, Wheel Balance, Steadyrests, Getting the Most Out of the Wheel, Wheel Mounting for Cylindrical Grinding, Centers in Work, Variable Work Speeds, Chatters on Nose of Cams, Cracks on Face of Cams, Effect of a Multiplicity of Cutting Points in Grinding, Steadyrest Work Shoes, Grinding Cast-Iron Pistons, What Produces Convex or Concave Surface in the Grinding of External and Internal Tapers? Soft Wheels, What Causes Cams to Show Softness after Grinding? Production, Grinding Lubricant, Wheel Feeds, Hand Grinding and Machine Grinding, Wheel Service in Cylindrical Grinding, Depth of Cut, Diamond Nibs and Holders, Automatic vs. Hand Feeding. Part II contains twenty-one articles on grinding kinks.

Selling Your Services. By George C. Pearson. 237 pp., 5 x 8. Published by the Jordan-Goodwin Corporation, Jefferson Bank Bldg., New York City. Price $2.00.

For the man who has no job, the man who has not the kind of job he desires, and the man who feels he has reached his limit in his present job, this little book will be of real benefit.

Knowing that the same fundamental laws that are effective in selling any product apply equally well to selling a man's services. Mr. Pearson has given in simple, practical, usable form, plans that any one can follow to conduct a successful campaign to sell his own services.

Such a book is of widespread interest today because many returned service men are still out of employment, and many of those who have secured work have had to accept jobs that do not give them a real chance to develop according to their ability.

The book is filled with practical examples of advertisements, circular letters, application letters, follow-up letters, and telegrams, most of which have actually been used in obtaining better opportunities for bookkeepers, salesmen, sales managers, foremen, accountants, advertising managers, clerks, stenographers, editors, etc. It is presented in very readable form.

The man who is looking for a chance to apply his present training and ability to the kind of work that will mean the most to him in personal development, satisfaction and money cannot afford to be without this very helpful book.

Forthcoming Meetings

The Association of Iron and Steel Electrical Engineers will hold a meeting at the Engineers' Club of Philadelphia, April 3.

The American Society Heating and Ventilating Engineers will hold a meeting at the Engineers' Club of Philadelphia, April 8.

The American Welding Society will hold its annual meeting at the Engineering Societies Building, 33 West 39th St., New York City, on Apr. 22, 1920, at 10:30 a.m. Howard C. Forbes is the secretary.

The National Metal Trades Association will hold a convention at the Hotel Astor, New York City, on April 19 to 22, 1920. H. D. Sayre is the secretary.

The National Chamber of Commerce will meet in Atlantic City, N. J., on April 26, 27 and 28.

The American Gear Manufacturers' Association wil hold a meeting at the Hotel Statler, Detroit, Mich., on April 29, 30 and May 1.

The American Supply and Machinery Manufacturers' Association, the Southern Supply and Machinery Dealers' Association and the National Supply and Machinery Dealers' Association will meet jointly on May 17, 18 and 19 at Atlantic City, N. J., at the Hotel Marlborough-Blenheim. F. D. Mitchell is the secretary and treasurer of the American Supply and Machinery Manufacturers' Association, with an office at 4106 Woolworth Building, New York City.

The National Machine Tool Builders' Association will hold its spring meeting on May 20 and 21 at the Hotel Traymore, Atlantic City, N. J.

The American Society of Mechanical Engineers will hold its spring meeting at St. Louis, Mo., May 24, 25, 26, 27, 1920, and will have its headquarters at the Hotel Statler.

The American Iron and Steel Institute will hold its spring meeting at the Hotel Commodore, New York City, May 28.

The American Drop Forge Association will hold a meeting at the Hotel Marlboro-Blenheim, Atlantic City, N. J., on June 17, 18 and 19. E. J. Frost, of the Frost Gear and Forge Co., Jackson, Mich., is president.

The American Society for Testing Materials will hold its next annual meeting during the week of June 21, 1920, at the New Monterey Hotel, Asbury Park, N. J. This society has its headquarters in the Engineers' Club Building, 1315 Spruce St., Philadelphia, Pa. C. L. Warwick is the secretary and treasurer.

Boston Branch, National Metal Trades Association. Monthly meeting on first Wednesday of each month, alternating with the Employers' Association of Eastern Massachusetts. George D. Berry, secretary, room 50-51, 166 Devonshire St., Boston, Mass.

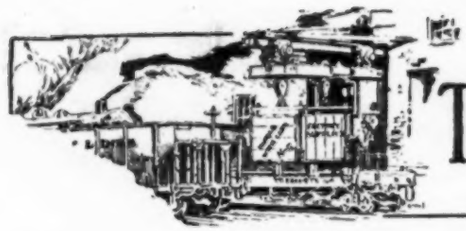
Engineers' Club of Philadelphia. Regular meeting the third Tuesday of the month. Lewis H. Kenney is the chairman of committee on papers.

Electric Hoist Maufacturers' Association. Monthly meeting at the offices of the Yale & Towne Manufacturing Co., 9 East 40th St., New York City. Secretary W. C. Briggs, Shepard Electric Crane and Hoist Co.

Engineers Society of Western Pennsylvania. Monthly meeting, third Tuesday; section meeting, first Tuesday. Elmer K. Hiles, secretary, Oliver Building, Pittsburgh, Pa.

Philadelphia Foundrymen's Association. Meeting first Wednesday of each month. Manufacturers' Club, Philadelphia, Pa., Howard Evans, secretary, Pier 45, North Philadelphia, Pa.

Rochester Society of Technical Draftsmen. Monthly meeting, first Thursday. O. L. Angevine, Jr., secretary, 547 Arnett Boulevard, Rochester, N. Y.



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

	Current	One Month Ago
CINCINNATI		
No. 2 Southern	$44.60	$44.60
Northern Basic	42.80	42.80
Southern Ohio No. 2	43.80	43.80
NEW YORK—TIDEWATER DELIVERY		
2X Virginia (Silicon 2.25 to 2.75)	47.65	47.65
Southern No. 2 (Silicon 2.25 to 2.75)	47.70	47.70
BIRMINGHAM		
No. 2 Foundry	41.00	41.00
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25-2.75 sil.	45.35-45.65*	45.35-45.65*
Virginia No. 2	43.25*	43.25*
Basic	43.00†	43.00†
Grey Forge	42.50*	42.50*
CHICAGO		
No. 2 Foundry local	43.25	43.25
No. 2 Foundry, Southern	46.60	46.60
PITTSBURGH, INCLUDING FREIGHT CHARGE FROM VALLEY		
No. 2 Foundry	43.65	43.65
Basic	42.90	42.90
Bessemer	43.40	43.40
MONTREAL		
Silicon 2.25 to 2.75%	43.25	43.25

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$3.97	$3.47	$4.07	$5.50	$3.97	$3.97	$4.07
Soft steel bars	4.12	3.52	3.97	5.00	4.07	3.87	3.97
Soft steel bar shapes	4.12	3.52	3.97		4.07	3.87	3.97
Soft steel bands	5.32	4.22	4.57	6.25			
Plates, ¼ to 1 in. thick	4.17	3.67	4.27	5.00	4.47	4.17	4.27

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$4.25	$2.90
Warehouse, New York	4.57	4.17
Warehouse, Cleveland	3.42	3.82
Warehouse, Chicago	3.52	4.10

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

	Large Mill Lots	New York			
Blue Annealed	Pittsburgh	Current	One Year Ago	Cleveland	Chicago
No. 10	3.55-4.00	6.12-6.80	5.17	7.30	6.02
No. 12	3.60-4.05	6.17-6.85	5.22	7.40	6.07
No. 14	3.65-4.10	6.22-6.90	5.27	7.45	6.12
No. 16	3.75-4.20	6.32-7.00	5.37	7.55	6.22
Black					
Nos. 18 and 20	4.15-4.80	7.30-7.30	6.02	7.95	6.80
Nos. 22 and 24	4.20-4.85	7.35-7.35	6.07	8.00	6.85
No. 26	4.25-4.90	7.40-7.90	6.12	8.05	6.90
No. 28	4.35-5.00	7.50-8.00	6.22	8.15	7.00
Galvanized					
No. 10	4.70-6.00	7.75-9.00	8.22	8.50	7.15
No. 12	4.80-6.10	7.85-9.10	8.27	8.60	7.20
No. 14	4.80-6.10	7.85-9.10	8.42	8.60	7.35
Nos. 18 and 20	5.10-6.40	8.15-9.40	8.72	8.90	7.65
Nos. 22 and 24	5.25-6.55	8.30-9.55	7.12	9.05	8.05
No. 26	5.40-6.70	8.45-9.70	7.27	9.20	8.20
No. 28	5.70-7.00	8.75-10.00	7.57	9.50	8.50

Acute scarcity in sheets, particularly black, galvanized and No. 16 blue enameled. **Automobile sheets are unavailable except in fugitive instances, when prices range to 15c per lb.**

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$5.50	$5.40	$5.50
Flats, squares and hexagons, per 100 lb. base	6.00	5.90	5.50-6.00

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent.
New York	55
Cleveland	50
Chicago	50

SWEDISH (NORWAY) IRON—The average price per 100 lb., in ton lots is:

	Current	One Year Ago
New York	$21.00-26.00	$25.50-30.00
Cleveland	20.00	20.00
Chicago	21.00	16.50

In coils an advance of 50c. usually is charged.
Domestic iron (Swedish analysis) is selling at 15c. per lb.

WELDING MATERIAL (SWEDISH)—Prices are as follows in cents per pound f.o.b. New York, in 100 lb. lots and over:

Welding Wire		Cast-Iron Welding Rods	
1/16, 3/32, 1/8, 5/32, 3/16, 7/32, No. 8, 1/4 and No. 10	21.00 to 30.00	1/4 by 12 in. long	14.00
5/16, No. 12		5/16 by 19 in. long	12.00
3/8, No. 14 and 7/16		3/8 by 19 in. long	10.00
No. 18		1/2 by 21 in. long	10.00
No. 20		Special Welding Wire, Coated	
Domestic 20c. for 1/16, 15c. for 1/8 to 3/16		1/8	33.00
		5/32	30.00
		3/16	38.00

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	6.00	8.00	9.00
Spring steel (light)	8.00	11.00	12.25
Coppered bessemer rods	8.00	8.00	7.35
Hoop steel	5.57	6.50	5.32
Cold-rolled strip steel	11.50	8.25	10.00
Floor plates	6.55	6.00	6.52

PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card, discounts on steel pipe, applying as from January 14, 1920, and on iron pipe from January 7, 1920.

BUTT WELD

Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
1/8, 1/4 and 3/8	47%	20½%	1/8 to 1/4	34½%	18½%
1/2	51%	36½%			
3/4 to 3	54%	41½%			

LAP WELD

2	47%	34½%	2	28½%	14½%
2½ to 6	50%	37½%	2½ to 6	30½%	17½%

BUTT WELD, EXTRA STRONG PLAIN ENDS

1/8, 1/4 and 3/8	43%	25½%	1/8 to 1/4	34½%	19½%
1/2	48%	35½%			
3/4 to 1½	52%	39½%			

LAP WELD, EXTRA STRONG PLAIN ENDS

2	45%	33½%	2	29½%	16½%
2½ to 4	48%	36½%	2½ to 4	31½%	19½%
4½ to 6	47%	35½%	4½ to 6	30½%	18½%

Stock discounts in cities named are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
⅛ to 3 in. steel butt welded	40%	24%	40%	31%	54%	40½%
2½ to 6 in. steel lap welded	35%	20%	42%	27%	50%	37½%

Malleable fittings. Class B and C, banded, from New York stock sell at plus 23%. Cast iron, standard sizes, net.

METALS

MISCELLANEOUS METALS—Present and past New York quotations in cents per pound, in carload lots:

	Current	One Month Ago	One Year Ago
Copper, electrolytic	18.50	19.00	16.00
Tin in 5-ton lots	61.50	60.00	72.50
Lead	9.00	8.75	5.25
Spelter	8.85	9.55	6.75
ST. LOUIS			
Lead	8.87½	8.375	5.00
Spelter	8.50	9.225	6.40

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

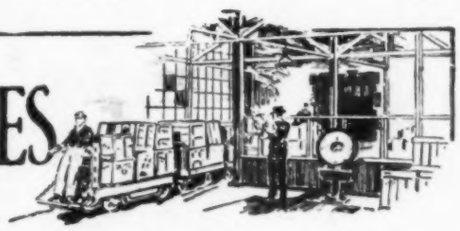
	New York			Cleveland		Chicago	
	Current	Month Ago	Year Ago	Current	Year Ago	Current	Year Ago
Copper sheets, base	29.50	29.50	22.50	31@32	24.50	36.00	32.00
Copper wire (carload lots)	29.25	29.25	23.00	29.50	23.00	27.00	28.50
Brass sheets	26.50	26.50	18.75	29.00	25.00	27.00	29.00
Brass pipe	32.00	32.00	28.00	34.00	33.00	35.00	37.00
Solder (half and half) (case lots)	39.00	39.00	46.50	40.50	41.50	38.00	39.00

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill. 100 lb. and over, warehouse; net extra:

	Current	One Year Ag
Mill	23.75	18.50
New York	23.75	19.50
Cleveland	27.00	24.00
Chicago	26.00	28.50

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound prevail:
Carload lots f.o.b. mill 12.00

	In Casks		Broken Lots	
	Current	One Year Ago	Current	One Year Ago
Cleveland	15.00	14.45	15.50	14.80
New York	14.00	12.00	14.50	13.00
Chicago	15.00	16.50	15.00	16.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	10.87½	7.50
Chicago	11.50	7.75
Cleveland	13.00	9.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York		Cleveland		
	Current	One Year Ago	Current	One Year Ago	Chicago
Copper, heavy, and crucible	16.50–17.25	13.00	17.00	14.00	17.25
Copper, heavy, and wire	15.75–16.25	12.00	17.00	13.00	16.25
Copper, light, and bottoms	14.50–15.00	10.50	15.50	11.00	15.25
Lead, heavy	7.25–7.50	4.25	8.50	4.00	7.75
Lead, tea	6.00–6.50	3.50	5.50	3.00	6.75
Brass, heavy	10.00–10.50	7.50	13.50	8.00	17.00
Brass, light	8.50–9.00	6.00	10.50	6.00	10.50
No. 1 yellow brass turnings	9.00–9.50	7.00	10.75	6.50	10.75
Zinc	5.25–5.50	4.50	6.00	3.50	6.50

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb.	33.00	34.00c.@35.00c.	33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	33.00	25.00
Chicago	29.00	28.00
Cleveland	32.00	28.00

BABBITT METAL—Warehouse price per pound:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	90.00	87.00	71.00	77.00	70.00	75.00
Commercial	50.00	42.00	21.50	18.50	15.00	15.00

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	+$3.00	25	$1.00	$1.75	$1.25	1.28
Hot pressed hexagon	+ 3.00	25	1.00	1.60	1.25	1.08
Cold punched hexagon	+ 3.00	2.25	1.00	1.50	.90	1.30
Cold punched square	+ 3.00	2.25	1.00	1.50	.90	1.30

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	40%	50–10%
Chicago	50%	50%
Cleveland	55%	60%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	20%	40+5%	35–5%
Larger and longer up to 1½ in. by 30 in.	10%	30%	25–5%

WASHERS—From warehouses at the places named the following amount is deducted from list price:
For wrought-iron washers:
New York, ... list Cleveland..... $3.75 Chicago..... $3.00
For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $5.00 Cleveland..... $4.50 Chicago..... $4.25

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	20%	40%	30%
Larger and longer up to 1 in. by 30 in.	10%	20+10%	20%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	20%	20%	30%	10%
Chicago	10%	10%	10%	Plus 5%
New York	10%	40% from list	10%	

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	30%	45%	45%
Tinned	30%	45%	45%

Boiler, ½, ⅝, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$6.00 Cleveland...$4.00 Chicago....$5.37 Pittsburgh...$4.72
Structural, same sizes:
New York...$6.10 Cleveland...$4.10 Chicago....$5.47 Pittsburgh....$4.82

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	34.00	36.00	35.00
Brass	33.00	34.00	34.00

For immediate stock shipment 3c. is usually added. The prices, of course, vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 2c.; for lots of less than 75 lb., but not less than 50 lb. advance is 5c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb. 10c. should be added to base price; quantities from 10-25 lb., extra is 25c.; less than 10 lb., add 35c.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ¼-2 in. inclusive in rounds, and ¼-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $1.50.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $8.50 per 100 lbs.

COTTON WASTE—The following prices are in cents per pound:

	NEW YORK			
	Current	One Year Ago	Cleveland	Chicago
White	13.00	13.00	16.00	11.00 to 14.00
Colored mixed	9.00 to 12.00	9.00–12.00	12.00	9.50 to 12.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½x13½	13½x20½
Cleveland	52.00	58.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.25	$2.25	$1.75
Philadelphia	2.00	2.00	1.75
Cleveland	2.50	2.50	2.75
Chicago	2.25	2.00	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.40	$3.40	$3.65
Cleveland	4.25	4.25	3.62
Chicago	5.00	5.00	4.125

COKE—The following are prices per net ton at ovens, Connellsville:

	Mar. 25	Mar. 18	Mar. 11	Mar. 4
Prompt furnace	$	$6.00	$6.00	$6.00
Prompt foundry		7.00	7.00	7.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	375-lb. bag	2.50

LINSEED OIL—These prices are per gallon:

	New York		Chicago	
	Current	One Year Ago	Current	One Year Ago
Raw in barrels (5 bbl. lots)	$1.87	$1.55	$2.05	$1.66
5-gal. cans (without cans)	1.87*	1.70	2.30	1.86

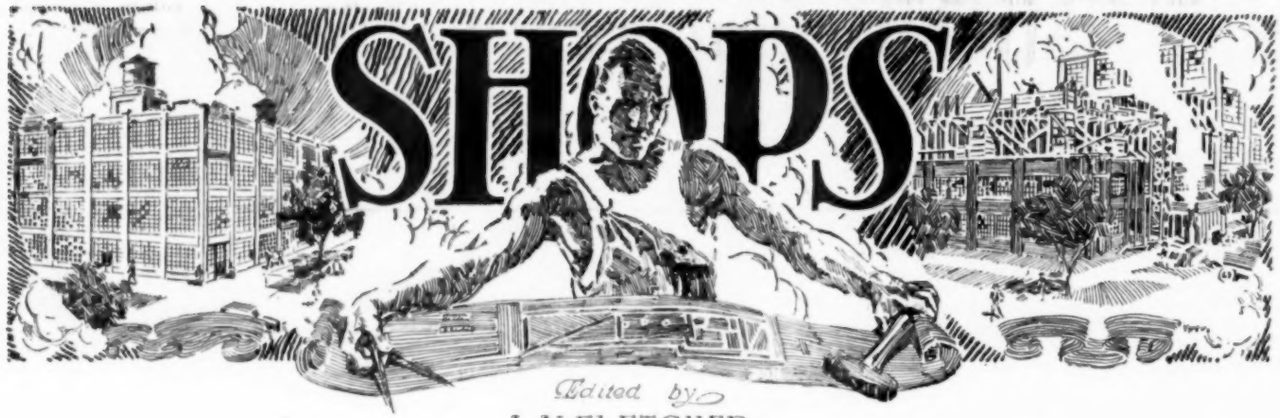
*To this *oil* price must be added the cost of the cans (returnable), which is $2.25 for a case of six.

WHITE AND RED LEAD—Base price per pound:

	Red				White	
	Current		One Year Ago		Current	One Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100 lb. keg	15.50	17.00	13.00	14.50	15.50	13.00
25 and 50-lb. kegs	15.75	17.25	13.25	14.75	15.75	13.25
12½-lb. keg	16.00	17.50	13.50	15.00	16.00	13.50
5-lb. cans	18.50	20.00	15.00	16.50	18.50	15.00
1-lb. cans	20.50	22.00	16.00	17.50	20.50	16.00

500 lb. lots less 10% discount. 2000 lb. lots less 10–2½% discount.

NEW and ENLARGED



Edited by
L·V·FLETCHER

Machine Tools

The following concerns are in the market for machine tools.

Conn., Bridgeport—The American Tube and Stamping Co.—one No. 162 Toledo Press with toggle or cam movement.

D. C., Washington—The Bureau of Ordnance, Navy Dept.—
Schedule 5817, open 4-6-20; thread milling machine for New port, R. I.
Schedule 5769, open 4-2-20; milling machine for Washington, D. C.
Schedule 5761, open 4-2-20; grinder for Newport, R. I.

Md. Baltimore—The Monumental Machine Co., 3505 Ellicott St.—one 32 in. lathe, long bed (used.)

N. J., Burlington—The American Cast Iron and Foundry Co.—American lathes.

N. Y., Buffalo—The Acme Pattern and Machine Co., 1553 Niagara St., E. H. Burgens, Purchasing Agt.—No. 2 plain Cincinnati milling machine.

N. Y., Buffalo—Keystone Tool and Metal Parts Corp., 65 Oak St., Purchasing Agt., M. L. Meyers, 132 Loring Ave.—general equipment to manufacture tools and metal parts.

N. Y., Lockport—The Mitchell Simpson Garage Co., 299 Walnut St.—machine tools for automobile repair work.

N. Y., Olean—The Clark Bros. Co.—Internal grinder.

N. Y., New York (Borough of Brooklyn)—J. Mock & Sons, Inc., 777 Rutland Rd.—1 light power punching machine, to take $\frac{5}{16}$ in. through $\frac{1}{2}$ in., also 1 light power cutting machine for cutting angles, or a combination machine to do this work.

N. Y., New York (Borough of Brooklyn)—The New York Municipal Rys., 85 Clinton St.—one 24 in. Turret lathe, without cross feed, but with countershaft.

N. Y., New York City (Borough of Brooklyn)—C. Ross & Son, 148 Classon Ave.—one 5 or 6 ft. radial drill (motor driven at 230-volt, d.c.)

N. Y., New York (Borough of Manhattan)—The Amer. Locomotive Co., 30 Church St.—7 hand screw machines, similar to No. 2, No. 3 or No. 7 B. & O., machines with set-over turret.

N. Y., New York (Borough of Manhattan)—The Arma Eng. Co., 252 West 29th St.—
One 27 in. swing lathe.
One Universal grinder, about 10 x 30 in. with automatic cross feed.
One 10-in. Universal dividing head.

N. Y., New York (Borough of Manhattan)—The Lehigh Valley R.R. Co., 143 Liberty St.—
(1) 2 100 ton bushing presses, motor drive.
(1A) 1 100 ton bushing press, motor drive.
(2) 1 turret lathe, motor driven, similar to Libby "Type C" swing over carriage 24 in., 6 ft. centers.
(3) 1 guide grinder, motor driven.
(4) 1 cold cut saw, motor driven.
(5) 2 36 to 44 in. side head boring mills, machines to include 3 jaw combination chuck unit, and thread cutting attachment.
(6) 1 heavy car wheel lathe, motor driven, work up to 36 in.
(7) 1 axle lathe, motor driven.
(8) 1 single punch, motor drive capacity $1\frac{1}{4}$ in. holes through 1 in. plates.
(9) 1 14 in. lathe, 3 ft. between centers, belt drive.
(10) 1 32 in. stroke shaper, belt drive, similar to Cincinnati heavy duty back geared crank shaper.
(11) $1\frac{1}{2}$ to 3 in. pipe cutter and threader, belt driven.
(12) 4 vertical turret lathes, motor driven, similar to Bullard 42 in. or N. B. P. vertical.
(13) 1 brass melting furnace, oil fired, 500 lb. capacity.
(14) 1 stock adjuster and upsetting machine.
(15) 2 throatless shearing machines, motor driven.
(16) 1 36 in. draw cut shaper, motor driven.
(18) 2 pipe machines, capacity $\frac{1}{4}$ up to 2 in. dies included.
(19) 1 500-ton hydraulic double end wheel press, motor driven, to take wheels up to 42 in.
(20) 1 36 in. throat double punch and shears, motor driven.
(21) 1 Underwood cylinder boring bar and fixtures.
(22) 1 500-ton double end wheel press complete, work up to 42 in.
(23) 1 extra heavy car wheel boring machine, motor drive, including 5 jaw chuck, boring bar and hoist.
(24) 1 automatic vertical hollow chisel mortising machine, motor driven.
(25) 1 large Universal woodworker, motor drive, (machine to be equipped with the following attachments):
1 $19\frac{1}{4}$ in. four side slotted steel cylinder and knives.
1 4 in. 4 side slotted steel side head and knives.
1 rabbeting, 1 jointing, and 1 capped molding head and knives.
1 adjustable bevel fence.
1 boring attachment with one $\frac{1}{2}$ and $\frac{3}{4}$ in. bits.
No countershaft.
1 12 in. rip saw, 12 in. cross saw, saw board and collars.
1 panel raising attachment, with paneling heads and bits.
1 gaining attachment.
1 adjustable gaining head 7 in. diameter works from $\frac{1}{2}$ to 1 in.
1 adjustable gaining head 10 in. diameter, works from 1 to 2 in.
Motor to be furnished with the machine to be A.C. 3 phase, 25 cycle, 440 volts.
Machine to be similar to J. A. Fay & Egan Co.'s No. $2\frac{1}{2}$ machine.
(26) 1 automatic railway cutoff saw, motor drive (machine to be equipped with the following equipment):
Frame cast in one piece.
Table fitted with 7 idler rolls, slotted fence and extension stops.
Mandrel housing driven by straight face reversing friction through rack and pinion.
Direct binder for the saw belt.
Expansion bush for centering saws.
One 40 in. saw.
Motor to be furnished with the machine to be A.C., 3 phase, 25 cycle, 440 volts.
Machine to be similar to J. A. Fay & Egan Co.'s No. 364 machine.

N. Y., New York (Borough of Manhattan)—The J. G. White Eng. Corp., 43 Exchange Pl.—one 15 in. x 10 ft. quick change gear lathe with double back gear.

Pa., Catasaqua—The Bryden Horseshoe Works—one No. 20 geared Bliss power press.

Pa., Merion—G. B. Darby, Highland—garage equipment.

Pa., Philadelphia—The Alfred Box Co., Inc., 813 North Fort St.—48 in. Gardner, Besley, or similar, horizontal disc grinder, also an automatic gear cutter or hobbing machine to cut small gears.

Pa., Philadelphia—W. Cramp & Sons Ship and Engine Building Co., Richmond and Norris Sts.—lathes (used).

Pa., Philadelphia—Merchant & Evans, 2035 Washington St., P. Flamming, Mgr.—lathes and drill presses.

Pa., Philadelphia—The Pennsylvania Steel Export Co., 940 Front St.—3 counter sinking machines, with or without motors, to handle 1 in. plates.

Pa., Philadelphia—The F. J. Stokes Machine Co., Cambria and 17th Sts.—machine shop equipment.

Pa., Philadelphia—The Swind Machinery Co., Widener Bldg.—2 Porter cable lathes.

Fla., Pensacola—Runyan & Co., East Hill Ave.—heavy duty lathe (new or used).

Ill., Chicago—The Athinson, Topeka and Santa Fe Ry., Ry. Exchange Bldg.—twist drill grinder complete with countershaft, size not specified (new).

Ill., Chicago—The Chicago Junction Ry., 38 Dearborn St.—
One 80 in. drive wheel lathe.
One 18 in. slotting machine.
One 54 in. boring mill.
One 16 in. lathe.
One 18 in. lathe (new).

Ill., Chicago—The Western Electric Co., Hawthorne Station—portable pipe threading and cutting machine with equipment 1-4 in. capacity (new).

Ill., Galesburg—Wenzelman Mfg. Co.—lathes for turning motor cases measuring $3\frac{1}{2}$ in. long, 7 in. outside diameter, 6 in. inside diameter (new or used).

Ill., Rockford—C. Kamper, 1027 Grant Ave.—screw cutting lathe.

Ind., Lafayette—The Fairfield Mfg. Co.—1 gear cutter.

Mich., Detroit—The Cable Draper Baking Co., Vermont St. and Marquette Ave.—equipment for repair shop.

Mich., Detroit—The Frigedaire Corp., 725 Scottern Ave.—pipe threading and cut off machines, 1 to 4 or 6 in. heavy duty.

Mich., Detroit—B. Gorman, 1441 14th St.—lathes, threading machine, drill press, grinder and complete machine shop equipment.

Mich., Detroit—H. J. Pelavin, 41 Sherman St.—equipment for automobile repair work.

Mich., Detroit—E. B. Stickley, East Congress St. and Cadillac Sq.—3 Gleason bevel gear generators.

Mich., Rochester—Birtch & Miers—engine lathe, drill press, miller.

O., Columbus—The Ceramic Supply and Constr. Co., 2783 North High St.—lathes, drill presses, power punches. W. D. Richardson, Purchasing Agt.

O., Mansfield—The Mansfield Steel and Tin Plate Co., Bowman St., R. S. Davey, Secy.—power punches, drill presses, plate working machinery.

Wis., Antigo—W. H. Maxon—machinery for garage repair work.

Wis., Milwaukee—The Milwaukee Hoist Co., 720 31st St.—one 18 in. engine lathe.

Wis., Milwaukee—The Milwaukee Press and Machinery Co., Montgomery Bldg.—drill presses.

Ia., Burlington — E. Showers — saws planes, drills, lathes, benches, etc.

Tex., Fort Worth—The Axtell Co.—one 24 in. engine lathe with turret head.

N. B., Moncton—The Moncton Tramway, Electricity & Gas Co., Tramway Bldg.—lathes.

Machinery

The following concerns are in the market for machinery.

D. C., Washington—The Bureau of Construction and Repair, Navy Dept.—Schedule 5794, open 4-9-20; deck planer for Bremerton, Wash.

N. Y., Johnson City—The Sweet Brothers Foundry, Grand Ave.—foundry equipment.

N. Y., Newark—The Wayne Wheel Co.—wood working machinery for barrel work.

N. Y., New York (Borough of Manhattan)—The Republic Doll and Toy Corp., 152 Wooster St.—grinding mill machinery to reduce dry wood flour.

N. Y., Syracuse—W. Matthews, 225 Cedar St—concrete block machinery.

Pa., Norristown—H. M. Jury, 662 Kohn St.—sand sifting and conveying machinery.

Pa., Philadelphia—The American Mfg. Co., Water and Morris Sts.—cordage machinery.

Ill., Rock Island—The Bear Mfg. Co.—50 ton punch press (used preferred).

Ind., Evansville—The Structural Supply Co.—aligator shears, 220 volt, 60 cycle, 3 phase a.c. motor, for cutting rounds and squares in reinforcing bars up to and including 1¼ in.

O., Cleveland—The Biggs-Watterson Co., 1235 West 9th St.—squaring gap shear, 60 to 72 in. to cut ⅜ in. steel plates.

O., Cleveland—The Foundry Equipment Co., 1831 Columbus Rd.—combination punch and shear, to take 1 in. diameter through 1 in. thickness, with throat 24 to 36 in. (new or used).

Wis., Albany—The Albany Hardware Specialty Mfg. Co.—one 2 ton screw chain hoist (new).

Wis., Black Earth—The Barsness Mfg. Co., E. S. Barsness, Mgr.—machinery for making iron stanchions.

Wis., Elroy—R. O. Steffen—machinery for wood working.

Wis., Green Bay—Green Bay Sugar Co., B. B. Bldg., A. Gardiner, Purchasing Agt.—traveling crane.

Wis., Milwaukee—The Confectioners Art Service Bureau, Montgomery Bldg.—machinery for the manufacture of fancy candy boxes.

Wis., Milwaukee—The Duplex Storage Battery Co., 537 Edison Ave.—woodworking machinery, jointer, etc.

Wis., Waukesha—The Waukesha Mfg. Co., 423 Arcadian Ave.—woodworking machinery.

Minn., St. Paul—M. R. Dean, 204 Essex Bldg.—machinery for the manufacture of automobile tires.

Cal., Anaheim—The Anaheim Co-operative Orange Association—sorting and packing machinery.

Cal., Glendale—Bd. Educ.—manual training equipment.

Cal., San Bernardino—The W. D. Anderson Co.—well drillers, 15 to 18 in. x 8 or 10 ft. or longer Q. C. gear and taper attachment, also screw cutting machine up to 2 in.

Cal., Willows—Bd. Educ.—manual training equipment.

Ont., London—The Columbia Handle Co., Adelaide St.—wood turning lathes.

Ont., Sarnia—The Sarnia Woolen Mills—textile machinery for woolens production.

Ont., Tilbury—The Tilbury Brick and Tile Co., Ltd.—
One hundred ton auger machine, oil bath gear boxes.
One hundred 24 in. gauge dryer cars, single or double deck.
Bensing automatic brick cutters, capacity 9 in.
Drain tile cutters, capacity 13¾ in.
Conveyor machinery, stationary and portable.
Six 1½ yd. two way side dump cars, 30 in. gauge.
Ten tons 12-25 lb. rails with fish-plates.
One 3 ton locomotive, 30 in. gauge.
Belting and shafting.

Metal Working

NEW ENGLAND STATES

Conn., Norwalk—Arnold & Co., Hoyt St., manufacturer of iron, will soon award the contract for the construction of a 1 story, 42 x 90 ft. foundry.

Mass., Boston—The Columbus Trust Co., c/o W. L. Miner, Archt., 46 Cornhill St., has awarded the contract for the construction of a 1 story, 90 x 160 ft. garage, on Tremont St. Estimated cost, $65,000.

Mass., Cambridge—A. Clayton & Co., 8 Winter St., Boston, has awarded the contract for the construction of a 1 story, 75 x 150 ft. garage, on Blanche St. Estimated cost, $45,000.

Mass., Cambridge — H. Fishman, 208 Prospect St., will build a 1 story, 76 x 107 ft. garage. Estimated cost, $30,000.

Mass., East Boston (Boston P. O.)—The Bertelsen & Peterson Eng. Co., 256 Border St., plans to build a ship repair plant. Estimated cost, $50,000.

Mass., Everett—The Sexton Can Co., 228 Franklin St., Boston, will soon award the contract for the construction of a 3 story, 80 x 120 ft. factory, on Cross St. Estimated cost, $80,000.

Mass., Natick—The New England Pressed Steel Co. plans to build a 1 story, 55 x 85 ft. factory. Estimated cost, $25,000.

Mass., New Bedford—J. D. Martin, Middle St., will soon award the contract for the construction of a 1 story, 70 x 115 ft. garage. Estimated cost, $25,000. Tuck & Gilman, 34 School St., Boston, Archts. and Engrs.

Mass., Quincy—P. S. Yerxa, 1452 Hancock St., plans to build a 1 story garage, on School St. Estimated cost, $40,000. W. H. Taylor, 50 Bromfield St., Boston, Engr. and Archt.

Mass., South Boston (Boston P. O.)—The Boston Ice Co., 110 State St., will soon award the contract for the construction of a 2 story, 32 x 36 ft. garage and office. Estimated cost, $15,000. H. R. Perkins, 8 Beacon St., Boston, Archt.

Mass., Springfield—The Moore Drop Forging Co., 38 Water St., has awarded the contract for the construction of a 1 story, 50 x 60 ft. factory. Estimated cost, $40,000.

Mass., Springfield—The Rolls Royce Co. of America, Page Boulevard, has awarded the contract for the construction of a factory, for the manufacture of automobiles. Estimated cost, between $20,000 and $25,000.

Mass., Worcester—N. Goldsmith, 56 Mechanics St., plans to build a 3 story garage, on Washington St. Estimated cost, $125,000.

Mass., Worcester—H. J. Murch, 731 Main St., will soon award the contract for the construction of a 1 and 2 story garage and service station, on Park Ave. Estimated cost, $150,000. Cutting, Carlton & Cutting, 44 Front St., Archts.

R. I., Providence—W. S. Achorn, Union and Fountain Sts., plans to build a 1 story garage, on Union St. Estimated cost, $36,000.

R. I., Providence—A. G. Potter, Crary St., has awarded the contract for the construction of a 1 story, 50 x 200 ft. garage, on Broad and Central Sts. Estimated cost, $40,000.

Vt., Derby Line—Butterfield & Co., manufacturer of taps and dies, is having plans prepared by Frost & Chamberlain, Archts., 390 Main St., Worcester, Mass., for the construction of a 3 story, 65 x 200 ft. factory. Estimated cost, $100,000.

MIDDLE ATLANTIC

Md., Baltimore—The Autogenous Welding and Machine Co., 1213-1223 Maryland Ave., has awarded the contract for the construction of a 1 story, 25 x 150 ft. addition to its welding plant. Estimated cost, $12,000.

Md., Baltimore—W. Cook, North and Greenmount Aves., is having plans prepared by J. S. Downing, Archt., 11 York Court, for the construction of a 1 or 2 story garage on Carter Pl. and McAllister Court. Estimated cost, $30,000.

Md., Baltimore—The Daylight Realty Co., 512 Equitable Bldg., will soon award the contract for the construction of a 1 story, 189 x 222 ft. garage, on Reisterstown Rd. near Gordon St. Estimated cost, $50,000. F. E. Beall, 1335 North Gilmor St., Archt.

Md., Baltimore—The Merton Realty Co., 1024 East Baltimore St., will build a 2 story, 62 x 92 ft. addition to its garage at 1510-1516 Guilford Ave. Estimated cost, $20,000.

Md., Baltimore—The Spann Motor Co., 3125 Philadelphia Ave., plans to build a 1 story, 150 x 169 ft. garage, at 3100 Philadelphia Ave. Estimated cost, $30,000. R. Milker, 330 East 33rd St., Archt.

Md., Mt. Clare (Baltimore P. O.)—The Baltimore & Ohio Railroad Co., Charles and Baltimore Sts., Baltimore, will soon award the contract for the construction of a 1 story, 28 x 140 ft. shop, tool room, office and rest room, on Pratt and Poppleton Sts., here. Estimated cost, $20,000. H. A. Lane, Ch. Engr.

Md., Orangeville—The Columbia Graphophone Mfg. Corp., Woolworth Bldg., New York City, has awarded the contract for the construction of a 6 story, 260 x 380 ft. factory on East Preston St. and Loneys Ave. Estimated cost, $2,500,000.

N. J., Harrison—The Driver Harris Co., manufacturer of metal ropes and wires, is building a 3 story, 52 x 100 ft. plant with 100 ft. wing. Upper floor to be used for general office, second for spooling and testing room, and ground floor for cleaning and shipping department. G. A. Richard, Advertising Mgr.

N. J., Newark—A. Becker, Monmouth St. and Waverly Ave., has awarded the contract for the construction of a 1 story, 50 x 100 ft. garage at 43 Lille St. Estimated cost, $15,000. Briscoe & O'Rourke, 786 Broad Sts., Archts.

N. J., Newark—The Genl. Alloy Co., 117 Walnut St., has awarded the contract for the construction of a 2 story, 30 x 78 ft. factory on Mulberry Pl. Estimated cost, $18,000.

N. J., Newark—Kehler & Goldstein, 294 Summer Ave., is having plans prepared by H. Rosensohn, Archt., 188 Market St., for the construction of a 1 story, 32 x 68 x 100 ft. garage, on Sussex Ave. Estimated cost, $15,000.

N. J., Newark—The McGann Co., 146 Front St., will soon award the contract for the construction of a 2 story, 49 x 82 ft. garage, at 141-142 Front St. Estimated cost, $10,000. N. Harris, 21 South Orange Ave., Archt.

N. J., Newark—The Wright Aeronautical Corp. of Amer., 40 Wall St., New York City, will soon award the contract for the construction of a 2 story, 45 x 200 ft. factory, on Meeke Ave. Estimated cost, $350,000.

N. J., Trenton—The Crescent Insulated Wire and Cable Co., Taylor St., has awarded the contract for the construction of a 3 story, 50 x 150 ft. addition to its plant, on North Olden Ave. Estimated cost, $40,000.

N. J., Trenton—The Trenton Steel and Wire Co., Hamilton Ave., plans to build a 100 x 200 ft. factory, on Ingham Ave. Smith, Boehm Co., Buffalo, N. Y., Archts.

N. Y., Buffalo—The Amer. Radiator Co. plans to build a 1 story cleaning room, at 1807 Elmwood Ave. Estimated cost, $12,000.

N. Y., Buffalo—The Art Works Co., Inc., 700 Main St., plans to build a 2 story, 75 x 108 ft. factory at 828-836 East Ferry St. for the manufacture of metal and leather goods. Estimated cost, $70,000. R. A. Wallace, Mutual Life Bldg., Archt.

N. Y., Buffalo—The Keystone Tool and Metal Parts Corp., recently incorporated with $50,000 capital, plans to remodel its plant at 65 Oak St. H. J. Meyers, 466 Best St., M. L. Meyers, 132 Loring Ave., and A. C. Ueck, 851 East Ferry St., are the incorporators.

N. Y., Buffalo—W. A. Morgan, 33 Gates Circle, plans to build a 1 story, 120 x 150 ft. garage, on West Utica St. J. Newton Byers, Jr., 461 Linwood Ave., Archt.

N. Y., Buffalo—The Strong Steel Foundry Co., 33 Norris St., plans to build two 1 story additions to its factory. Estimated cost, $20,000.

N. Y., Comstock—C. Rattigan, Supt. State Prisons, Albany, will soon award the contract for the construction of a 1 story, 170 x 60 ft. shop at Great Meadow Prison, here. Estimated cost, $50,000.

N. Y., Jamaica—The Dictograph Co. has awarded the contract for the construction of a 1 story, 50 x 145 ft. factory, on School Pl. and Chichester Ave.

N. Y., Laurelton (Jamaica P. O.)—Hathron Homes Co., c/o A. W. Pierce, Archt. and Engr., 26 Court St., Brooklyn, plans to construct a 1 story, 100 x 100 garage on Merrick Rd. Estimated cost, $30,000.

N. Y., Lockport—The Mitchell Simpson Garage Co., 299 Walnut St., plans to rebuild its 2 story garage which was recently destroyed by fire. Estimated cost, between $50,000 and $60,000.

N. Y., New York (Borough of Bronx)—A. Guidone, 52 Vanderbilt Ave., will build a 1 story, 100 x 100 ft. garage, on Fordham Rd. Estimated cost, $35,000. Moore & Landseidel, 3rd Ave. and 148th St., Archts.

N. Y., New York (Borough of Brooklyn)—The Allied Bldg. Corp., 158 Broadway, will build a 1 story, 100 x 145 ft. garage. Estimated cost, $35,000.

N. Y., New York (Borough of Brooklyn)—The Amer. Numbering Machine Co., 226 Shepard Ave., will soon award the contract for the construction of a 2 story, 50 x 100 ft. factory and garage, on Atlantic Ave. Estimated cost, $40,000. H. G. Dangler, 215 Montague St., Engrs. and Archts. B. Connatto, Pres.

N. Y., New York (Borough of Brooklyn)—F. Keim, 411 Frontman St., will build a 1 story, 100 x 100 ft. garage, on Frontman St. and Wykoff Ave. Estimated cost, $25,000.

N. Y., New York (Borough of Brooklyn)—M. E. Lucki, 21 Suydam St., will build a 1 story, 75 x 150 ft. garage, on Utica Ave. Estimated cost, $50,000.

N. Y., New York City (Borough of Brooklyn)—E. A. Richards, 147 Barbey St., Brooklyn, will build a 1 story, 90 x 100 ft. garage on Fanchon Pl. and Bushwick Ave. Estimated cost, $43,000.

N. Y., New York (Borough of Manhattan)—H. Davidowitz, 316 Stanton St., will build a 2 story, 200 x 200 ft. garage, at 40 West End Ave. Estimated cost, $100,000.

N. Y., New York (Borough of Manhattan)—W. Laive, 2145 Boston Rd., will build a 1 story, 100 x 150 ft. garage, at 523 East 70th St. Estimated cost, $30,000.

N. Y., New York (Borough of Manhattan)—The Standard Oil Co., 26 Broadway, has awarded the contract for the construction of a 2 story, 100 x 125 ft. garage and shop at 631 West 46th St. Estimated cost, $95,000.

N. Y., Ogdensburg—The Cooper's Brass Wks., Inc., have awarded the contract for the construction of a factory. Estimated cost, $87,000.

N. Y., Potsdam—The Club Garage, Elm St., G. B. Matthews, Prop. plans to build a 2 story machine shop and storage building. Estimated cost, $15,000.

N. Y., Schenectady—The Mica Insulator Co., 46-60 Villa Rd., has awarded the contract for the construction of a 4 story, 50 x 130 ft. addition to its factory. Estimated cost, $125,000.

N. Y., Watertown—The Watertown Engine and Machine Co., 882 West Main St., plans to build a 55 x 100 ft. addition to their plant.

Pa., Chester—Allison & Co., Law Bldg., manufacturer of forgings and castings, has awarded the contract for the construction of a 1 story, 62 x 202 ft. factory. Estimated cost, $100,000.

Pa., Johnstown—The Twin Valley Motor Corp., 216 Dibert St., will soon award the contract for the construction of a 2 story, 212 x 218 ft. garage and repair shop, at 212-18 Main St. Estimated cost, $130,000.

Pa., Merion—G. B. Darby, Highland, has awarded the contract for the construction of a 2 story, 30 x 60 ft. garage. Estimated cost, $15,000.

Pa., Millersburg—The Alvord Reamer and Tool Co. is building a 40 x 60 ft. addition to its plant.

Pa., Philadelphia—The Crosstown Realty Co., c/o Neubauer & Supowitz,, Engrs. and Archts., 929 Chestnut St., has awarded the contract for the construction of a 1 story, 36 x 115 ft. and 92 x 100 ft. garage. Estimated cost, $35,000.

Pa., Philadelphia—The F. J. Stokes Machine Co., Cambria and 17th Sts., will soon award the contract for the construction of a 1 story, 90 x 160 ft. machine shop, on Tabor and Perry Aves. Estimated cost, $10,000.

Pa., Philadelphia—C. Williams, 2340 North 32nd St., will build a 2 and 3 story, 35 x 50 ft. and 16 x 60 ft. garage and office building, on Dauphin and 30th Sts. Estimated cost, $60,000.

Pa., Shamokin—A. H. Hershner will build a 3 story, 30 x 80 ft. garage. Estimated cost, $30,000.

SOUTHERN STATES

W. Va., Wheeling—The Globe Automatic Sprinkler Co., 420 1st Natl. Bank Bldg., Cincinnati, O., has awarded the contract for the construction of a 1 story, 100 x 230 ft. factory. Estimated cost, $100,000.

MIDDLE WEST

Ill., Chicago—The Alemite Die Casting & Mfg. Co., 341 West Chicago Ave., will build a plant at the northeast corner of Belmont and Washtenaw Aves., to have 100,000 sq. ft. of floor space.

Ill., Chicago—The Block Mfg. Co., 1219 West Lake St., will soon award the contract for the construction of a 2 story, 95 x 110 ft. factory, on Fulton and Wood Sts., for the manufacture of sheet metal goods. Estimated cost, $65,000. Dubin & Eisenberg, 139 North Clark St., Archts.

Ill., Chicago—The Pheoll Mfg. Co., 5700 Roosevelt Rd., has awarded the contract for the construction of a 1 story, 115 x 220 ft. addition to its factory, for the manufacture of hardware goods. Estimated cost, $65,000.

Mich., Detroit—The Automobile Crank Shaft Corp., 192 Piquette Ave., has awarded the contract for the construction of a 1 story, 40 x 166 ft. factory. Estimated cost, $20,000. Noted Jan. 22.

Mich., Detroit—The Blodgett Eng. and Tool Co., Kerr Bldg., plans to build a 4 story factory, on 14th and Dalzelle Sts. A. E. Harley, 435 Woodward Ave., Archt.

Mich., Detroit—The Cable Draper Baking Co., Vermont St. and Marquette Ave., plans to build a 2 story, 90 x 150 ft. garage on Vermont St. and Ferry Park Ave. Estimated cost, $40,000. Pollmar & Ropes, 45 State St., Archts.

Mich., Detroit—H. J. Pelavin, 41 Sherman St., plans to build a 1 story, 60 x 200 ft. garage on Erskine St. Estimated cost, $25,000.

Mich., Detroit—C. E. Smith & Co., 708 Empire Bldg., has awarded the contract for the construction of a 2 story, 100 x 200 ft. garage on John R. St. Noted March 4.

Mich., Detroit—The Stuber Co., 775 Cass Ave., will soon award the contract for the construction of a 1 story, 87 x 160 ft. garage, on Cass and Warren Aves. Estimated cost, $50,000. E. R. Dunlap, 709 Hammond Bldg., Archt.

Mich., Detroit—The Superior Machine and Eng. Co., 51 East Fort St., will soon award the contract for the construction of a 3 story, 100 x 120 ft. factory, on East Larned and St. Aubin Sts. Estimated cost, $100,000. Brown & Preston, 406 Empire Bldg, Detroit, Engrs. and Archts.

O., Ashtabula—The Ashtabula Steel Co. has been chartered with a capital of $1,500,000 for the manufacture of steel products. R. Lock, H. M. Kunkle, H. W. Luethi, C. L. Shaylor and T. J. Rennick are the incorporators.

O., Canton—The Timken Detroit Axle Co., Waynesburg Rd. and Belden Ave., S. E., plans to build a 1 story 100 x 150 ft. core making building. The H. M. Lane Co., 701 Owen Bldg., Detroit, Engrs.

O., Cincinnati—The Cincinnati Iron and Steel Co., Front and Freeman Aves., plans to build a 250 x 700 ft. factory, on Front St. Estimated cost, $200,000.

O., Cincinnati—The J. H. McGowan Pump Co., Central and 2nd Aves., plans to build a foundry, on Oakley Ave. B. L. Baldwin, 2nd Natl. Bank Bldg., Archt.

O., Cincinnati—The Monitor Stove and Range Co., North Gest St., plans to build a factory on Edwards Road. Estimated cost, $1,000,000. Austin & Co., 16112 Euclid Ave., Archts.

O., Cleveland—The Buckeye Brass Co., 6410 Hawthorne Ave., has awarded the contract for the construction of a 1 story 30 x 110 ft., 75 x 75 ft., and 18 x 35 ft. foundry, furnace and wash room on Ashland Road. Estimated cost, $75,000. Noted Mar. 4

O., Cleveland—The City Machine Co., 5321 St. Clair Ave., has awarded the contract for the construction of a 1 story, 50 x 126 ft. addition to its machine shop. Estimated cost, $50,000. J. Gray, Mgr.

O., Cleveland—The Cleveland Automobile Co., East 131st St., has awarded the contract for the construction of a 2 story, 80 x 240 ft. factory and a 1 story, 80 x 80 ft. heat treating plant, on London Rd. Total estimated cost, $210,000. Noted Mar. 11.

O., Cleveland—A. Gardner, 6912 Carnegie Ave., will soon award the contract for the construction of a 1 story, 30 x 60 ft. shop and factory on Central Ave. Estimated cost, $10,000. A. F. Janowitz, Permanent Bldg., Archt.

O., Cleveland—F. W. Holstein, 1536 Lakefront Ave., will build a 2 story, 30 x 59 ft. factory, at 2163 East 19th St., for the manufacture of tools. Estimated cost, $10,000.

O., Cleveland—The Industrial Iron Wks. Co., 13,310 Saranac Rd., plans to build a 1 story, 68 x 75 ft. factory. Estimated cost, $8,000.

O., Cleveland—The L. N. N. Foundry Co., 2088 Scranton Rd., will soon award the contract for the construction of a 1 story, 35 x 80 ft. foundry addition. Estimated cost, $30,000. G. E. Rudolph, c/o Owner, Archt.

O., Cleveland—The Natl. Acme Co., 7500 Stanton Ave., manuacturer of machinery, is having plans prepared by G. S. Rider & Co., Engrs. and Archts., Century Bldg., for the construction of a 1 story addition to its factory, on East 131st St. and Coit Rd. Estimated cost, $500,000.

O., Cleveland—The Nat'l Steel Barrel Co. has awarded the contract for the construction of a 1 story, 125 x 160 ft. addition to its factory at 3860 East 91st St. Estimated cost, $50,000. P. R. Long, 3860 East 91st St., Secy.

O., Cleveland—The Operative Stove Co., 6712 Central Ave., has awarded the contract for the construction of a 2 story, 31 x 75 ft. foundry, at 2323 East 67th St. Estimated cost, $50,000.

O., Cleveland—The Otis Steel Co., Jennings Rd., will build a 1 story, 100 x 115 ft. machine shop. Estimated cost, $50,000.

O., Cleveland—The A. E. Russ Machine Co., 208 Schofield Bldg., plans to build a 2 story factory, on East 134th St. near St. Clair Ave. Estimated cost, $50,000. A. E. Russ, Pres.

O., Cleveland—The W. S. Tyler Co., 3735 Superior Ave., manufacturer of ornamental iron, will build a 1 story, 45 x 85 ft. machine shop at 1423 East 36th St. Estimated cost, $10,000. G. S. Rider & Co., Century Bldg., Archts.

O., Cleveland—The Union Rol'ing Mills Co., East 82nd St. and Aetna Rd., will soon award the contract for the construction of a 1 story, 61 x 200 ft. crane runway. Estimated cost, $50,000. J. B. Davis & Son, 876 The Arcade, Engrs. and Archts.

O., Columbus—The Carroll Thompson Co., 539 East Long St., plans to build a 1 story 150 x 150 ft. service station. Estimated cost, $150,000. H. J. Dauben, 560 South 3rd St., Archt.

O., Columbus—The Ohio Auto Sales Co., 772 North High St., will soon award the contract for the construction of a 3 story, 60 x 188 ft. service station on 9th and Broad Sts. Estimated cost, $150,000. Basset & Tresselt, Central Natl. Bank Bldg., Archts.

O., Dayton—The Dairy Eng. Co., Beaver Bldg., plans to build a 4 story, 60 x 180 ft. administration building, a 1 story, 70 x 160 ft. machine shop and a 4 story, 68 x 220 ft. factory, on West 2nd St., for the manufacture of dairy machinery. Estimated cost, $800,900.

O., Dayton—The Gen'l Motors Co., Taylor St., has awarded the contract for the construction of a 6 story, 120 x 300 ft. factory on 1st and Foundry Sts., for the manufacture of electrical appliances. Estimated cost, $250,000.

O., Dayton—H. Gerstner & Sons, Cincinnati St., plans to build a 3 story, 40 x 80 ft. factory, on Columbia and Cincinnati Sts., for the manufacture of tools. Estimated cost, $25,000.

O., Springfield—The Springfield Malleable Iron Co., 37 Bechtle Ave., is having plans prepared by the Concrete Steel Constr. Co., Archts., 415-416 Mitchell Bldg., for the construction of a 2 story, 80 x 100 ft. addition to its factory on the West Side. Estimated cost, $40,000.

O., Xenia—The Xenia Foundry and Machine Co. plans to build a 1 and 2 story, 110 x 260 ft. foundry, on North West St. Estimated cost, $75,000. Pretzinger & Musselman, City Natl. Bank Bldg., Dayton, Archts.

O., Youngstown—The Reliance Wheel Co. has awarded the contract for the construction of a 1 story, 100 x 210 ft. factory. Estimated cost, $150,000. J. N. Crenan, Pres.

Wis., Beloit—The Beloit Iron Wks. Co. has awarded the contract for the construction of a 1 story factory. Estimated cost, $350,000.

Wis., Burlington—The Burlington Brass Wks. is having plans prepared by E. B. Funston, Archt., Robinson Bldg., Racine, for a 1 story, 100 x 140 ft. foundry.

Wis., Manitowoc—The Aluminum Goods Mfg. Co., 15th and Franklin Sts., plans to build a 2 story, 60 x 350 ft. rolling mill, on Main St. Estimated cost, $500,000. Lockwood Greene & Co., South Dearborn St., Chicago, Ill., Archts.

Wis., Menomonee Falls—The Schumann Motor Co. has awarded the contract for the construction of a 1 story, 75 x 150 ft. garage. Estimated cost, $50,000. Noted Feb. 12.

Wis., Sheboygan—The Last Trimming Co., c/o A. C. Last, Pres., 1525 Georgia Ave., has awarded the contract for the construction of a 2 story, 80 x 145 ft. factory, on 15th St., for the manuacture of automobile tops. Estimated cost, $50,000.

Wis., Sheboygan—The Optenberg Iron Wks., South 7th St. and Clara Aves., has purchased a site, and plans to build a 2 story, 60 x 110 ft. factory, on North 8th St. Estimated cost, between $50,000 and $60,000.

WEST OF THE MISSISSIPPI

Minn., Coleraine—Bd. Educ. will soon award the contract for the construction of a 2 story, 200 x 200 ft. school to include a manual training department, on Main St. Estimated cost, $500,000. W. T. Bray, Tarrey Bldg., Duluth, Archt. and Engr.

Minn., Minneapolis—The Berger Mfg. Co., 300 10th Ave. S., will build a 1 story, 80 x 112 ft. addition to its factory, on Ulysses St. and Broadway, for the manufacture of steel ceilings. Estimated cost, $60,000. W. C. Westby, c/o owner, Archt.

Mo., Joplin—The Keystone Driller Co., 12th and Illinois Sts., has awarded the contract for the construction of a 1 story, 125 x 140 ft. factory. Estimated cost, $100,000.

Okla., El Reno — The Tompkins Motor Car Co. is having plans prepared for the construction of a 2 story, 50 x 120 ft. garage. Estimated cost, $70,000.

Okla., Enid—R. R. Kisner is having plans prepared by R. W. Shaw, Archt., Enid, for the construction of a 2 story, 50 x 150 ft. garage. Estimated cost, $55,000.

Okla., Oklahoma City—Zalondek & Bahn, 607 Colcord Bldg., plans to build a factory for the manufacture of spark plugs. Estimated cost, $100,000.

Okla., Okmulgee—J. H. Rebold plans to build an aviation field, on a 40 acre tract near residence, to include 1 large hangar capable of accommodating 15 aeroplanes, also machine house and store house. Estimated cost, $165,000.

WESTERN STATES

Cal., Emeryville (Oakland P. O.)—The Johnson Electric Washer Co. has awarded the contract for the construction of a 1 story, 120 x 134 ft. factory, on 40th and Adeline Sts. Estimated cost, $40,000.

Cal., Glendale—Bd. Educ. has awarded the contract for the construction of a 2 story school, to include a manual training department, on Broadway. Estimated cost, $79,000.

Cal., Lancaster—The Trustees of Lancaster Union High School District are having plans prepared by J. C. Austin, Archt., 1125 Baker-Detwiler Bldg., Los Angeles, for the construction of a 2 story high school, to include a manual training department, etc. Estimated cost, $200,000.

Cal., Los Angeles—A. Shorten and W. Curtiss, 1104 Santa Fe Ave., have awarded the contract for the construction of a 1 and 2 story, 99 x 120 ft. factory and warehouse on Santa Fe Ave. and 15th St. Estimated cost, $18,000. Concrete Machinery Co., lessee.

Cal., Los Angeles—The University Club, Consolidated Realty Bldg., is having plans prepared by E. L. Mayberry, Engr., 468 Pacific Electric Bldg., and Allison & Allison, Archts., 1405 Hibernian Bldg., for the construction of a 1 story, 65 x 135 ft. garage in connection with an 8 story, 65 x 135 ft. clubhouse on Hope near 6th St. Estimated cost, $400,000.

Cal., San Jose—The Natl. Axle Co. has awarded the contract for the construction of a 1 story, 90 x 136 ft. factory, on old Luna Park site. Estimated cost, $60,000.

Cal., Willows—Bd. Educ. is having plans prepared by W. H. Weeks, Archt., 75 Post St., San Francisco, for the construction of a 2 story school, to include a manual training department. Estimated cost, $123,000.

CANADA

N. B., Moncton—The Moncton Tramway, Electricity & Gas Co., Tramway Bldg., plans to build a machine shop. Estimated cost, $150,000.

Ont., Brockville—Machinery and Foundries, Ltd., plans to build a 1 story, 60 x 150 ft. foundry. Estimated cost, $60,000. C. R. Young, Engr. Bldg., University of Toronto, Toronto, Engr., B. Dillon, 43 King St., E., Brockville, Archt.

Ont., Toronto—The Grinnell Co., Ltd., is having plans prepared by The H. M. Lane Co., Ltd., Windsor, for the construction of a 1 story, 100 x 150 ft. foundry.

General Manufacturing

NEW ENGLAND STATES

Conn., Ansonia—The Ansonia O. & C. Co., 153 Main St., will soon award the contract for the construction of a 2 story, 80 x 125 ft. factory for the manufacture of braid, webs, etc. Estimated cost, $100,000. Lockwood Greene & Co., 101 Park Ave., New York City, Engrs. and Archts.

Conn., Groton—The M. Pollock Co., 12 East 22nd St., New York City, has awarded the contract for the construction of a 3 story factory, for the manufacture of thread.

Conn., New Britain—Landers, Frary & Clark, Commercial St., are having plans prepared by M. J. Unkelbach, Archt., 162 Main St., for the construction of a 1 story, 50 x 104 ft. factory for the manufacture of cutlery. Estimated cost, $25,000.

Mass., Boston—Boston & Lockport Stone Co., East Boston, has awarded the contract for the construction of a 1 story, 40 x 100 ft. factory, on Conder St. Estimated cost, $110,000.

Mass., Brockton—The G. E. Keith Co., 23 Station Rd., has awarded the contract for the construction of a 4 story, 60 x 400 ft. and 60 x 80 ft. factory, for the manuacture of shoes. Estimated cost, $350,000. Noted Mar. 11.

Mass., Cambridge—A. R. Hyde & Co., 432 Columbia St., will build a 2 story, 30 x 115 ft. factory, for the manufacture of shoes. Estimated cost, $25,000.

Mass., Easthampton — The Hampton Mills Co., bleachers, plans to build a 4 story factory, on Kingsley Ave.

Mass., Everett—The Bunker Hill Shoe Co., Broadway, will soon award the contract for the construction of a 4 story, 90 x 100 ft. factory, for the manufacture of shoes. Estimated cost, $90,000. Burk & Bottomley, 34 School St., Boston, Engrs. and Archts.

Mass., Fitchburg—The Fitchburg Paper Co., 804 Main St., has awarded the contract for the construction of a mill, on a site near its present plant. Estimated cost, $400,000.

Mass., Jamaica Plains (Boston P. O.)—The T. G. Plant Co., Bickford St., has awarded the contract for the construction of a 1 story, 50 x 200 ft. factory, for the manufacture of shoes. Estimated cost, $20,000.

Mass., Northampton—The McCallum Hosiery Co., 136 West St., manufacturer of silk hosiery, has awarded the contract for the construction of a 3 story factory.

R. I., Westerly—The Lorraine Mfg. Co., 547 Mineral Springs Ave., manufacturers of textile goods, has awarded the contract for the construction of a 4 story, 106 x 108 ft. mill building, a 1 story, 145 x 350 ft. weave shed and a 1 story, 116 x 120 ft. warehouse, on Mechanic St. Estimated cost, $400,000.

MIDDLE ATLANTIC STATES

Md., Dukes (Adelena P. O.)—The West Virginia Paper & Pulp Co., 200 5th Ave., New York City, plans to build two 2 story factories. Estimated cost, $300,000. Lockwood-Greene Co., 101 Park Ave., New York City, Archts. and Engrs.

N. J., Newark—The Alliance Button Co., Lawrence and Mechanic Sts., is having plans prepared by J. Green, Archt., 27 Clinton St., for alterations to its factory. Estimated cost, $50,000.

N. J., Newark—The Mueller Ecclesiastical Art Wks., 89 Plain St., will soon award the contract for the construction of a 3 story, 18 x 50 ft. and a 2 story, 46 x 47 ft. shop. Acerman & Seider, 45 Clinton St., Archts.

N. J., South River—S. Blumenthal & Co. has awarded the contract for alterations to its silk mill. Estimated cost, $25,000.

N. J., Trenton—The Natl. Porcelain Co., Southard St., will soon award the contract for the construction of a 2 story, 51 x 72 ft. plant. Estimated cost, $20,000. R. Consolloy, Commonwealth Bldg., Archt.

N. J., Trenton — The Thermoid Rubber Co., Whitehead Rd., has awarded the contract for the construction of a 1 story, 150 x 200 ft. mill. Estimated cost, $75,000.

N. J., West New York—The Gibralter Tire & Rubber Co., 234 4th Ave., New York City, has awarded the contract for the construction of a 1 and 2 story, 90 x 140 ft. factory on Hudson County Blvd. and 13th St. Estimated cost, $60,000.

N. Y., New York (Borough of Brooklyn)—The Bemis Bag Co., c/o Lockwood-Greene & Co., 101 Park Ave., New York City, has awarded the contract for the construction of a 3 story, 175 x 200 ft. factory on 51st and 52nd Sts. and 2nd Ave. Estimated cost, $500,000.

N. Y., New York (Borough of Queens)—H. R. Mallinson & Co., c/o Lockwood & Greene, 101 Park Ave., New York City, has awarded the contract for the construction of a 2 story, 125 x 207 ft. mill for the manufacture of silk. Estimated cost, $225,000. Noted March 4.

N. Y., Syracuse—The Will & Baumer Co., Liverpool, plans to build a 3 story, 72 x 255 ft. factory on Liverpool Rd., here, for the manufacture of candles. Estimated cost, $200,000. G. L. Noble, Union Bldg., Engr. and Archt.

Pa., Philadelphia — The American Mfg. Co., Water and Morris Sts., has awarded the contract for the construction of a 1, 2 and 3 story factory on Shunk and Front Sts., for the manufacture of rope. Estimated cost, $500,000.

Pa., Wilkes-Barre—The Hess Goldsmith Co., 83 Waller St., will soon award the contract for the construction of a 1 story silk mill. Estimated cost, $200,000. A. Freeman, 29 West 34th St., New York City, Archt. and Engr.

SOUTHERN STATES

Ga., Griffin — The Georgia Cotton Mills plan to build a new bleachery and reorganize their present plant. J. E. Sirrine, Greenville, S. C., Engr.

La., Baton Rouge—The Constantin Refining Co., New 1st Natl. Bldg., Tulsa, Okla., plans to build an oil refinery, 20,000 bbl. capacity, on a 600 acre tract 2½ mi. north of here. Estimated cost, $2,000,000.

La., Mansfield—The Hagan Producing & Refining Co. plans to build an oil refinery. Estimated cost, $1,000,000.

La., New Orleans—The Simms Oil Co. plans to build a 20,000 bbl. refinery here at tidewater terminus, 280 mi. 8 in. pipe line from here to Sibley, also install 7 pumping stations at 40 mi. intervals. About $12,000,000. C. B. Deming, Vice. Pres.

La., Shreveport—The Associated Producing and Refining Co. has acquired a 37 acre site and plans to build an oil refinery, to have a capacity of 1,000 bbl. Estimated cost, $100,000.

La., Shreveport—The Great Southern Producing and Refining Co., 1007 Hume Mansur St., Indianapolis, Ind., plans to build a 1,500 bbl. refinery, near here. R. N. Miller, Genl. Mgr.

N. C., Charlotte—J. H. Cutter & Co. is having plans prepared by J. E. Sirrine, Engr., Greeneville, S. C., for a compress and a warehouse to have a storage capacity of 30,000 bales.

S. C., Gaffney—The Musgrove Mills will build a 3 story, 107 x 290 ft. mill for the manufacture of cotton cloth, to include 15,000 spindles. J. E. Sirrine, Greenville, S. C., Engr.

S. C., Greenville—The Union Bleaching and Finishing Co. has awarded the contract for an addition to their plant.

S. C., Greenville—The Woodside Cotton Mills Co. has awarded the contract for the construction of a plant to include several mill buildings.

Va., South Boston—The Halifax Cotton Mills are having plans prepared by J. E. Sirrine, Engr., Greenville, S. C., for the construction of a 133 x 243 ft. weave shed, to include 225 looms.

W. Va., Charleston—The Sauquoit Silk Mfg. Co., c/o Lockwood, Greene & Co., Archts. and Engrs., 101 Park Ave., New York City, will soon award the contract for the construction of a 3 story, 52 x 200 ft. silk throwing mill.

MIDDLE WEST

Ill., Chicago—The Amer. Glue Co., 123 West Kinzie St., has awarded the contract for the construction of a 3 story, 100 x 112 ft. factory, at 3640 Iron St. Estimated cost, $175,000.

Ill., Chicago—The Shotwell Mfg. Co., 1021 West Adams St., has awarded the contract for the construction of a 4 story, 100 x 200 ft. factory on Potsmer and St. Lewis Sts., for the manufacture of candy. Estimated cost, $300,000.

Ind., Kokomo—The Kokomo Chemical Co., 129 East Sycamore St., is building a plant for the manufacture of aluminum salts and heavy chemicals. H. M. Gray, Pres.

Mich., Detroit—Dean & Sherk, 812 Woodbridge St., have awarded the contract for the construction of a 3 story, 40 x 60 ft. factory on Bellevue and Mack Aves., for the manufacture of thread. Estimated cost, $25,000.

Mich., Grand Rapids—The Hanford Lumber Co., Russell St., is having plans prepared by P. Lindhout, Archt., 817 Lake Drive, for the construction of a 2 story, 50 x 100 ft. factory. Estimated cost, $45,000.

Mich., Monroe—The Monroe Paper Products Co., West Elm St., is having plans prepared for the construction of a 2 story factory for the manufacture of paper boxes. Estimated cost, $100,000.

O., Akron—The B. F. Goodrich Co., South Main St., manufacturer of rubber goods, has awarded the contract for the construction of two 7 story, 80 x 160 ft. addition to its plant. Estimated cost, $1,000,000.

O., Cleveland—The Abraham Brudno Co., 1261 West 6th St., plans to build a 6 story, 42 x 60 ft. factory on West 6th St. near St. Clair Ave., for the manufacture of cigars. Estimated cost, $75,000.

O., Cleveland—The Enamel Products Co., Eddy Rd. and Taft Ave., has awarded the contract for the construction of a 2 story, 40 x 51 ft. addition to its factory. Estimated cost, $10,000.

O., Lorain—The J. O. Newman Cigar Co., 3808 Woodland Ave., will soon award the contract for the construction of a 3 story factory. Estimated cost, $35,000. Fulton & Taylor, Hippodrome Bldg., Cleveland, Archt.

O., Cleveland—The Natl. Lamp Co., Nela Park, East Cleveland, has awarded the contract for the construction of a 1 story, 100 x 220 ft. laboratory. Estimated cost, $100,000.

Wis., Sheboygan—The Wisconsin Textile Biproducts Co., Calumet Rd., is having plans prepared by W. C. Weeks, Archt., Ontario Ave., for the construction of either a 2 story, 60 x 87.6 ft. addition to present building or a 72.6 x 60 ft. new building. Estimated cost, $30,000.

WEST OF THE MISSISSIPPI

Ia., Burlington—E. Showers, plans to build a 1 story, 100 x 300 ft. factory, on Des Moines St. for the manufacture of furniture. Estimated cost, $500,000. N. Ferguson, Burlington, Engr.

Kan., Wichita—The Johnson-Larimer Dry Goods Co. is having plans prepared by L. Schmidt & Co., 121 North Market St., for the construction of a 5 story, 140 x 175 ft. factory. Estimated cost, $150,000.

Kan., Wichita—The Western Lithographing Co., 125 North Emporia Ave., will soon award the contract for the construction of a 7 story, 60 x 140 ft. factory. Estimated cost, $200,000. Lorentz Schmidt & Co., 121 North Market St., Archts.

Minn., Minneapolis—The Cootey Co., 325 3rd St., has awarded the contract for the construction of a 4 story, 80 x 120 ft. printing factory on 6th St. and 7th Ave., S. Estimated cost, $175,000.

Minn., Pelican Rapids—The Farmers' Co-operative Creamery Association plans to build a creamery. Estimated cost, $60,000. C. W. Kampfer, 103 Bates Ave., St. Paul, Minn., Archt. M. Sorenson, Mgr.

Minn., Rapidan—The Rapidan Creamery Co. plans to build a 2 story, 50 x 60 ft. creamery. Estimated cost, $75,000. C. Mohr, Secy. A. Schipped, 809 Coughlin-Hickey Bldg., Mankato, Archt.

Minn., St. Paul—The Thompson Yards, Inc., 5th and Roberts Sts., is having plans prepared by O. W. Johnson, Archt., 2003 Ashland Ave., for the construction of a 2 story, 96 x 592 ft. factory on University Ave., near city limits, for the manufacture of sashes and doors.

Mo., Carthage—The F. H. Lynch Tire and Rubber Co., Kansas City, is having plans prepared by The Akron Eng. Co., Akron, O., for the construction of a 2 story factory. Estimated cost, $150,000.

Mo., Dearborn—The Lynch Tire & Rubber Co. is having plans prepared by the Akron Eng. Co. for the construction of a 2 story, 180 x 240 ft. factory. Estimated cost, $125,000.

Tex., Texas City—The White Oil Corp., 501 5th Ave., New York City, has acquired an 800 acre site here and plans to build a refinery to have capacity of 15,000 bbl. T. R. Hancock, Mgr.

WESTERN STATES

Cal., Anaheim—The Anaheim Co-operative Orange Association will build a packing house on Center St. S. Evans, Supt.

Cal., Healdsburg—The Pacific Evaporating Co. is having plans prepared by W. Falch, Archt., Hearst Bldg., San Francisco, for the construction of a 1 story fruit dryer. Estimated cost, $50,000.

Cal., Sacramento—The Virden Packing Co. plans to construct a packing plant, in West Sacramento, to include a group of 1-3 story buildings. Estimated cost, $1,500,000. F. F. Atkinson, Milan Bldg., Secy.

Cal., Wilmington—The California Barium and Chemical Co., c/o J. O. Sword, Higgins Bldg., Los Angeles, recently incorporated with $250,000 capital, is having plans prepared by A. C. Martin, Archt., 430 Higgins Bldg., for the construction of a factory.

Wash., Chehalis—The Lewis Pacific Co. Dairymen's Association has purchased a site on Chehalis Ave., and plans to build a 1 story factory for the manufacture of powdered milk. Estimated cost, $25,000.

CANADA

B. C., Vancouver—The British Columbia Printing and Lithographing Co., Smith and Homer Sts., will soon award the contract for the construction of a 1 story, 120 x 175 ft. factory, on Homer and Helmcher Sts. Estimated cost, $80,000. Dalton & Eveleigh, Dave's Chambers, Archts.

Ont., London—The Columbia Handle Co., Adeliade St., plans to build a factory, for the manufacture of wood handles. Estimated cost, $25,000. W. H. Bradden, Mgr.

Ont., London—The W. A. Jenkins Mfg. Co., 363 Ridont St., plans to build a flour mill. Estimated cost, $150,000.

Ont., Ottawa—The Dept. of Public Wks. has awarded the contract for the construction of a dairy plant at Experimental Farm. Estimated cost, $29,680.

Ont., Sarnia—The Sarnia Woolen Mills is having plans prepared by Watt & Blackwell, Archts., Bk of Toronto Chambers., London, Ont., for the construction of a 2 story, 40 x 90 ft. mill. Estimated cost, $25,000.

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Auction Notices	Employment Agencies	Miscellaneous Wants	Positions Vacant	Salesmen Wanted
Buildings for Sale	Exchanges	New Industries Wanted	Positions Wanted	Second Hand Machinery
Business Opportunities	For Rent Items	Partners Wanted	Property for Sale	Patents for Sale

See the Searchlight Section in this issue.

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